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A COMPUTER PROGRAM FOR ASSESSING THE ECONOMIC  
FEASIBILITY OF SOLAR ENERGY FOR SINGLE-FAMILY  
RESIDENCES AND LIGHT COMMERCIAL APPLICATIONS

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**Solar Energy**



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## TECHNICAL MEMORANDUM

# A COMPUTER PROGRAM FOR ASSESSING THE ECONOMIC FEASIBILITY OF SOLAR ENERGY FOR SINGLE-FAMILY RESIDENCES AND LIGHT COMMERCIAL APPLICATIONS

## I. INTRODUCTION

A solar heating system operating on free sunlight can typically supply 50 to 70 percent of the home space heating and hot water load. This savings in conventional fuel cost (either electricity, natural gas or oil) over many years in the future is the incentive for spending the extra money to install a solar heating system. Because of the possibility of extended bad weather, a conventional heating system capable of providing 100 percent of the heating load is always required. This conventional system would serve as a backup when a solar heating system is also installed. So the question of whether to spend the extra money depends on how much you can expect to save in the future and, perhaps more importantly, how long you are willing to wait to get those savings.

Classically, life cycle costing is the method used to evaluate economic alternatives. The individual cash flow profiles of each alternative are discounted to present dollars and the cheapest selected. However, individual homeowners do not generally make decisions on a life cycle cost basis. Fifteen or twenty years is probably too long to wait and the first four or five years is when most people would want their investment in solar to "pay back." The following definitions, from Reference 1, are useful:

For individual homeowners, solar marketers have found that cash flow measures are paramount. Three measures are particularly important, each in terms of time:

- Years to positive cash flow is the number of years for fuel cost savings to become greater than the extra expenses of the solar system, after taxes. The criterion assumed is two years, because most homeowners expect rapid savings for an "energy conserving" investment.
- Years to recover downpayment is the number of years required for accumulated savings to offset initial cash payments and early cash flow losses, after taxes. The criterion assumed is five years, based on today's

average housing turnover rate of five years and the expectation that homeowners will seek to recover their downpayment before selling.

- Payback period is the number of years for accumulated savings to repay the full cost of the system (or equal the remaining principal on a loan if financed). The criterion assumed is ten years, assuming the homeowner wishes to be paid back entirely for his investment in no more than ten years.

The computer program provides a cash flow analysis for each year so that any decision criteria selected can be applied with the data provided.

There are some important economic considerations involved in "sizing" a solar heating system. Here "sizing" means selecting a collector area and performance and determining the resultant percentage of the total annual load carried by the solar system. See Reference 2 for a more detailed discussion. There are fixed and variable costs in a solar installation. Fixed costs consist of pumps, controls, ducts, etc. Variable costs are mainly due to collector area. As the collector area increases, the solar system carries a greater percentage of the annual load. The characteristic curve of solar system life cycle cost versus collector area is depicted in Figure 1. For low collector areas, not much sunlight is captured; hence, little heating value is achieved. A relatively large amount of money has been spent to perform the heating equivalent of a small amount of conventional fuel. At high collector areas a similar uneconomical phenomena occurs. Adding collector area, when it is already relatively high, provides a small increase in the percent of total load carried by the solar system. Hence the added collector area and cost is only slightly reducing the conventional fuel bill. There is a collector area which minimizes life cycle cost, as depicted on Figure 1. However, this may not be the size of solar system most attractive to the homeowner from an economic standpoint. Consider the economic decision involved in moving the design from the area of minimum life cycle cost along Path A (i.e., in the direction of reducing the collector area). The characteristic curve is relatively flat near the area of minimum life cycle cost. Reducing collector area has an almost linear effect on reducing system initial cost. A penalty is paid, however, in terms of increased life cycle cost. The important point here is that savings in initial cost may be relatively large, and hence attractive to the homeowner, in comparison to the life cycle cost penalty. The sensitivity study and plot features of the computer program allow these alternatives to be studied.

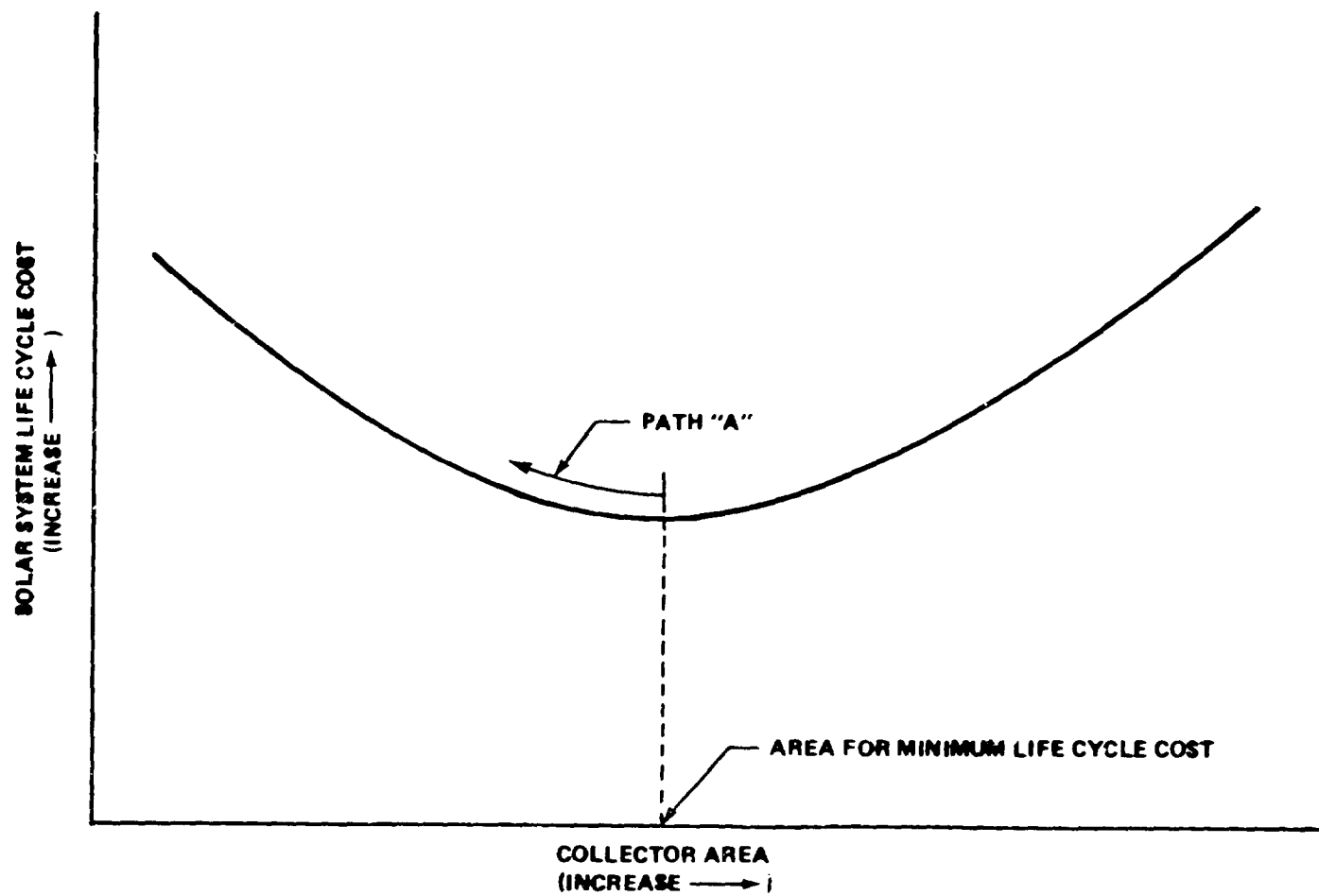


Figure 1. Characteristic curve: life cycle cost versus collector area.

## A. Cost Elements

Comparing the life cycle cost of a solar heating system with a conventional system requires, first of all, the identification of costs which are expected to be different over the life of the two alternatives. One of the alternatives is to have a conventional system perform 100 percent of the load using conventional fuel. The second alternative is to have both a solar heating system and a conventional system. In this second alternative, the solar heating system would carry from 50 to typically 70 percent of the total load and the conventional system carry the remaining 30 to 50 percent. The conventional system in this second alternative is sized, however, to have the capability to carry 100 percent of the load if lack of sunlight makes the solar heating system temporarily useless.

The approach adopted in this report is to provide a fairly comprehensive list of cost elements which may be an important part of any economic analysis and let the program user select the ones to include for his particular circumstances. Table 1 lists these cost elements and gives a brief discussion of their meaning. The work of Rosalie Ruegg [3] contains an excellent discussion of methods of economically evaluating solar heating systems. The program described here follows her work closely.

## B. Solar Heating System Sizing

Sizing a solar heating system requires knowledge of the total annual heating load of the home. Methods of doing this are readily available [4]. Collector area is considered a variable in this formulation in that the user chooses the one of maximum economic benefit. Starting with an initial collector area and performance characteristics, it is then necessary to determine the percent of the annual load carried by the solar system. There are numerous methods for doing this [2,5]. The GFL Method [5] has been built into the computer program. By selecting a region of the country (from the list of 151 cities in Table 2), a collector area, and the type of working fluid (air or liquid) the computer program determines the percent of total load carried by the solar heating system. The GFL method requires the selection of collector performance parameters. The following values, which are considered typical, are built into the program.

For an air system  $F'_{R\tau\alpha} = 0.6$  and  $F'_{R U_L} = 4.0 \text{ W/M}^2 \cdot ^\circ\text{C}$ . For a liquid system  $F'_{R\tau\alpha} = 0.75$  and  $F'_{R U_L} = 4.0 \text{ W/M}^2 \cdot ^\circ\text{C}$ . If the program user has other values for collector performance parameters, they can be input to the program. Also, if the percent solar fraction is known it can be input and the GFL Method will not be used.

TABLE 1. COST ELEMENTS WORKSHEET

Cost Element	Description	Life Cycle Costing Calculation	User Problem Data Worksheet
Acquisition	Initial costs incurred by purchase, delivery, installation and integration.	Treated as initial, one-time cost and is not discounted or inflated. A down-payment factor may be applied.	
Building Modifications	Co.'s due to structural modifications required for the system.	Treated as initial, one-time cost and is not discounted or inflated.	
Net Replacement and Repair	Yearly cost of replacements and repair to the system.	Cost input in year incurred, then inflated and discounted.	
Maintenance	Estimated annual cost for maintenance of total system.	Initial value input for first year, then inflated and discounted.	
Conventional Fuel Cost	Annual conventional fuel and energy costs required for system operation.	Annual cost for first year input, then inflated by energy escalation factor and discounted.	
Property Taxes	Property taxes paid due to assessed value of the equipment.	Same method as for Maintenance.	
Property Tax Credits	Deductions from income tax due to property taxes paid.	Income tax rate times taxes paid.	
Maintenance Expense Credits	Reduces commercial taxable income.	Income tax rate times expenses.	
Depreciation Credit	Commercial deduction from taxes.	Straight line method, no inflation.	
Added Income	Increased rental of solar compared to conventional property due to lower utilities.	Income is taxed and discounted.	
Insurance	Cost of insurance on the system.	Net annual cost input and discounted, not inflated.	
Salvage	Expected value at end of life.	Discounted.	
Loan Payments	Annual loan payments on borrowed funds.	Loan is amortized and yearly payment computed. Yearly interest computed. Payment is discounted.	
Loan Interest Credits	Tax deduction due to interest paid.	Interest from loan computed and discounted.	
Conventional Fuel Cost Credit	Commercial tax deduction.	Annual cost for first year input, then inflated by energy escalation factor.	



TABLE 2. CITY LISTING

1. Abilene, Texas	47. Fort Wayne, Indiana
2. Albany, New York	48. Fort Worth, Texas
3. Albuquerque, New Mexico	49. Fresno, California
4. Amarillo, Texas	50. Gainesville, Florida
5. Ames, Iowa	51. Glasgow, Montana
6. Amherst, Massachusetts	52. Grand Junction, Colorado
7. Annapolis, Maryland	53. Grand Lake, Colorado
8. Apalachicola, Florida	54. Great Falls, Montana
9. Asheville, North Carolina	55. Green Bay, Wisconsin
10. Astoria, Oregon	56. Greensboro, North Carolina
11. Atlanta, Georgia	57. Grandville-Spartanburg, North Carolina
12. Atlantic City, New Jersey	58. Griffin, Georgia
13. Big Spring, Texas	59. Hartford, Connecticut
14. Billings, Montana	60. Houston, Texas
15. Binghamton, New York	61. Indianapolis, Indiana
16. Birmingham, Alabama	62. Inyokern, California
17. Bismarck, North Dakota	63. Ithaca, New York
18. Bluehill, Massachusetts	64. Jackson, Mississippi
19. Boise, Idaho	65. Jacksonville, Florida
20. Boston, Massachusetts	66. Kansas City, Missouri
21. Boulder, Colorado	67. Key West, Florida
22. Brownsville, Texas	68. Lake Charles, Louisiana
23. Cape Hatteras, North Carolina	69. Lander, Wyoming
24. Caribou, Maine	70. Lansing, Michigan
25. Charleston, South Carolina	71. Laramie, Wyoming
26. Charlotte, North Carolina	72. Las Vegas, Nevada
27. Chattanooga, Tennessee	73. Lemont, Illinois
28. Chicago, Illinois	74. Lexington, Kentucky
29. Cleveland, Ohio	75. Lincoln, Nebraska
30. Columbia, Missouri	76. Little Rock, Arkansas
31. Columbus, Ohio	77. Los Angeles, California
32. Corpus Christi, Texas	78. Louisville, Kentucky
33. Corvallis, Oregon	79. Lynn, Massachusetts
34. Dallas, Texas	80. Macon, Georgia
35. Davis, California	81. Madison, Wisconsin
36. Dayton, Ohio	82. Manhattan, Kansas
37. Denver, Colorado	83. Medford, Oregon
38. Des Moines, Iowa	84. Memphis, Tennessee
39. Detroit, Michigan	85. Miami, Florida
40. Dodge City, Kansas	86. Midland, Texas
41. Duluth, Montana	87. Milwaukee, Wisconsin
42. East Lansing, Michigan	88. Minn-St. Paul, Minnesota
43. El Paso, Texas	89. Mt. Weather, Virginia
44. Ely, Nevada	90. Nashville, Tennessee
45. Fargo, North Dakota	91. Natick, Massachusetts
46. Fort Smith, Arkansas	92. New Orleans, Louisiana

TABLE 2. (Concluded)

93. Newport, Rhode Island	138. Spokane, Washington
94. New York, New York	139. State College, Pennsylvania
95. Norfolk, Virginia	140. Stillwater, Oklahoma
96. North Omaha, Nebraska	141. Summit, Montana
97. Oak Ridge, Tennessee	142. Syracuse, New York
98. Oklahoma City, Oklahoma	143. Tallahassee, Florida
99. Page, Arizona	144. Tampa, Florida
100. Parkersburg, West Virginia	145. Trenton, New Jersey
101. Pasadena, California	146. Tucson, Arizona
102. Pensacola, Florida	147. Tulsa, Oklahoma
103. Peoria, Illinois	148. Twin Falls, Idaho
104. Phoenix, Arizona	149. Washington, D.C.
105. Philadelphia, Pennsylvania	150. Wichita, Kansas
106. Pittsburgh, Pennsylvania	151. Yuma, Arizona
107. Pocatello, Idaho	
108. Port Arthur, Texas	
109. Portland, Maine	
110. Portland, Oregon	
111. Prosser, Washington	
112. Pueblo, Colorado	
113. Pullman, Washington	
114. Put-in-Bay, Ohio	
115. Raleigh, North Carolina	
116. Raleigh-Durham, North Carolina	
117. Rapid City, South Dakota	
118. Reno, Nevada	
119. Richland, Washington	
120. Richmond, Virginia	
121. Riverside, California	
122. Rochester, New York	
123. Sacramento, California	
124. St. Cloud, Minnesota	
125. St. Louis, Missouri	
126. Salt Lake City, Utah	
127. San Antonio, Texas	
128. San Diego, California	
129. San Francisco, California	
130. San Jose, California	
131. Santa Maria, California	
132. Savannah, Georgia	
133. Sault St. Marie, Michigan	
134. Schenectady, New York	
135. Seattle, Washington	
136. Shreveport, Louisiana	
137. Silver Hill, Maryland	

## C. Sensitivity Studies

Selecting values of certain key cost parameters, such as future conventional fuel escalation rates, requires subjective judgment. The program is designed to study a range of values of certain parameters in one run or execution of the program. The parameters which can be varied are collector area, discount rate, inflation rate, down payment factor, property tax rate and income tax rate. The plot feature of the program produces plots of life cycle cost as a function of any of these parameters.

## II. USER PROBLEM FORMULATION

The total life cycle cost of the solar and conventional energy system is computed by adding the individual life cycle costs of the basic cost elements which are appropriate for the type of analysis desired. The user selects the basic cost elements which he considers important. There are fifteen possible cost elements (Table 1) covering an extensive range of possibilities for residential and commercial applications.

The life cycle cost calculation is formulated for computer solution in the classic Work Breakdown Structure (WBS) format. See Reference 6 for a description of the WBS concept. In this application of the WBS concept each cost element is a block in the WBS where costs are accumulated from sub-elements at a lower level and are summed to cost elements at a higher level. A three level WBS is illustrated in Figure 2. The highest level block, Solar System Life Cycle Cost, is a Level I block and contains the total life cycle costs of the solar system. There are 7 Level II blocks illustrated from Acquisition to Loan Interest Credits. Note that the Level II block titles are cost elements from Table 1. Level III is illustrated by showing that Acquisition has been further sub-divided into various hardware components as well as Integration and Installation.

The first step in formulating the user problem is to select from Table 1 the cost elements for the solar and conventional energy system to be analyzed. It may save some work for the user to recall that when comparing life cycle costs for two competing systems, it is only necessary to consider cost elements which may be different for the two systems. For example, if no significant difference in property tax is expected between the solar and conventional system, then it is not necessary to include that cost element in the analysis of either.

The next step is to construct a WBS. This is a very important step and must be done properly for successful program execution. The key decisions which the user must make for each WBS block are its proper level, title, WBS number and block number. Figure 2 illustrates these concepts.

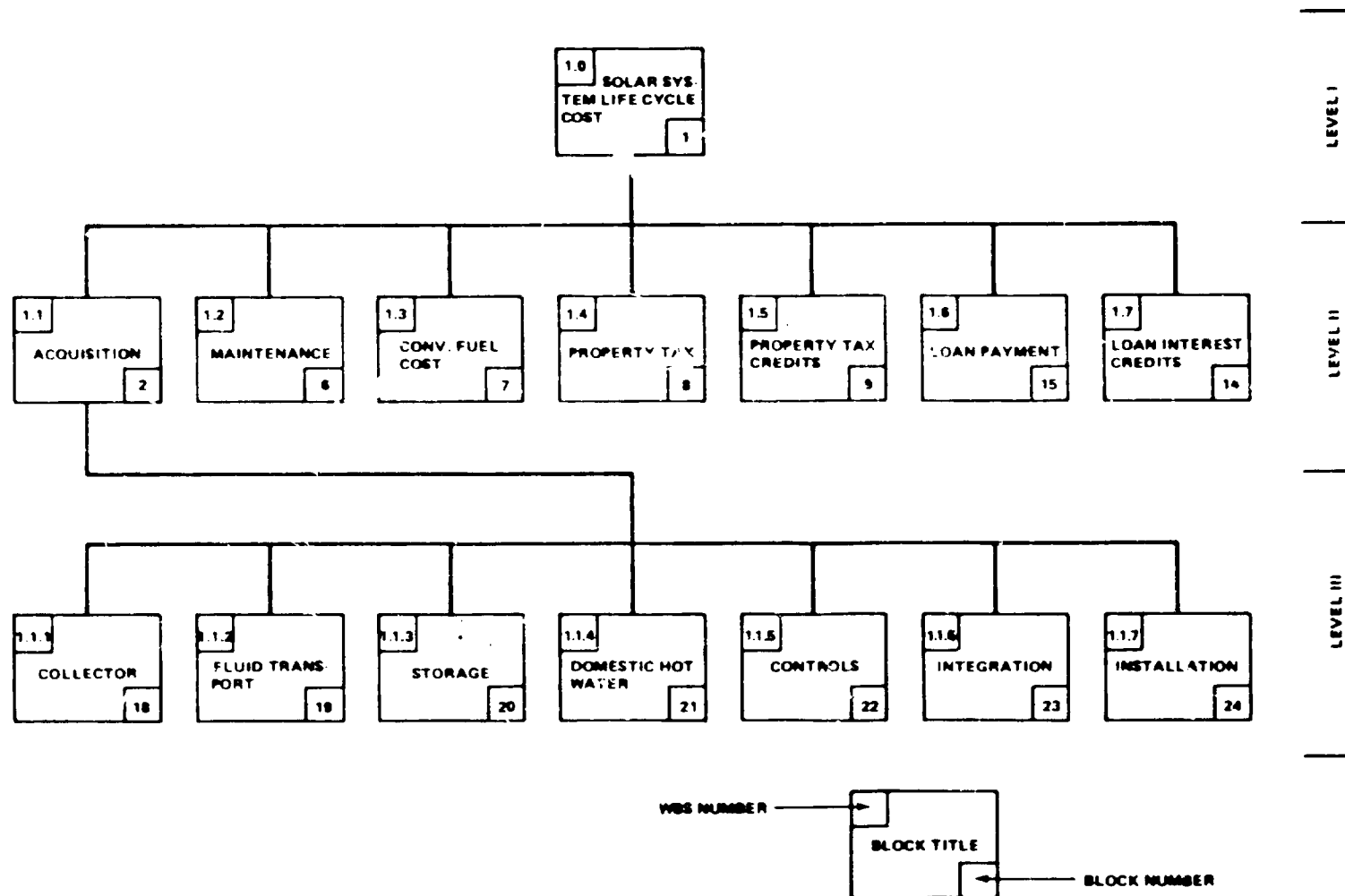
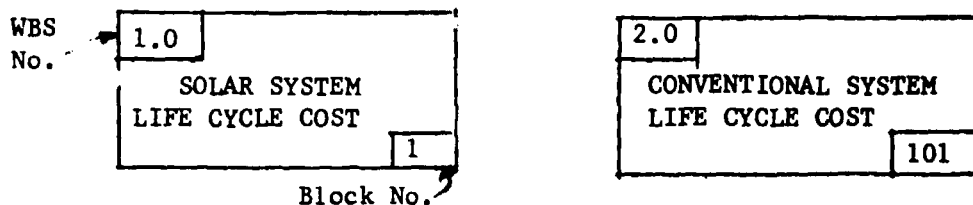


Figure 2. WBS for typical solar system life cycle cost analysis.

## A. Rules for Constructing the WBS

1. Level I Blocks. Two (no more, no less) Level I blocks are necessary. They must have the following titles, WBS numbers and block numbers:



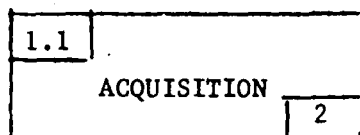
There will usually be several Level II blocks under each of these Level I blocks.

### 2. Level II Blocks.

a) Each Level II block must be one of the cost elements from Table 1.

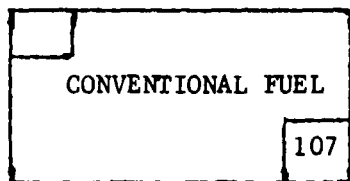
b) There will be two groups of Level II blocks, one group under the Level I block Solar System Life Cycle Cost, and the other under the Level I block Conventional System Life Cycle Cost.

c) The first Level II block under WBS 1.0 must be:



This block must be included in each problem and have the indicated WBS number, title and block number. There are usually several other Level II blocks under WBS 1.0.

d) The other Level I block, WBS 2.0, must contain the following Level II block with indicated title and block number:



Note that no specific WBS number is required. A logical number to assign to it will become evident to the user as the construction of the WBS continues.

e) The number of additional Level II blocks under each Level I block depends on which additional cost elements the user decides to consider.

f) When a cost element is selected and made a Level II block, its title and block number are restricted. Block titles at Level II are always the same as cost elements from Table 1. Block numbers at Level II are restricted to the values shown in Table 3.

g) Remaining to be selected are the WBS numbers for Level II blocks. From an understanding of the WBS concept, logical numbers under the Level I block number 1.0 would be 1.1, 1.2, 1.3, etc. and under 2.0 would be 2.1, 2.2, 2.3, etc.

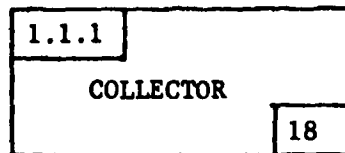
TABLE 3. COST ELEMENT BLOCK NUMBERS

Block Title (Cost Element)	When Selected to Go Under 1.0, Must Have the Block Number	When Selected to Go Under 2.0, Must Have the Block Number
Acquisition	2	102
Building modifications	3	103
Space occupied	4	104
Repair	5	105
Maintenance	6	106
Conventional fuel	7	107
Property taxes	8	108
Property tax credits	9	109
Depreciation credits	10	110
Added income	11	Not applicable
Insurance	12	111
Salvage	13	112
Loan payments	15	114
Loan interest credits	14	113
Maintenance expense credits	16	115
Fuel cost credits	17	116

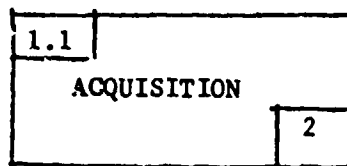
### 3. Level III Blocks.

a) The purpose of having Level III blocks available is to allow the user to specify additional detail, if desired, for each Level II block he selects. For example, under the cost element salvage value for a solar system, the user may choose to break down the total salvage value due to the collectors, hot water system, controls, etc.

b) There is one level III block required in all problems,

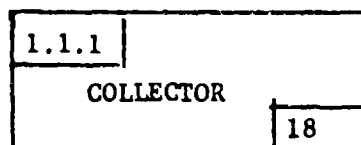


and it must have the indicated WBS number, block title and block number. It must go under the Level II block:



c) When Level III blocks are used, the user is in effect creating sub-cost elements under a Level II block. The sub-cost elements are treated the same mathematically as the Level II cost element they are under. It is important that the sum of all the Level III block costs under a particular Level II block equal what would have been input for the Level II block cost had the user not elected to go to the Level III detailed breakout. Additionally, after having elected to go to Level III detail, it is not necessary to input the data at Level II since the computer will sum the Level III input data and results at Level II.

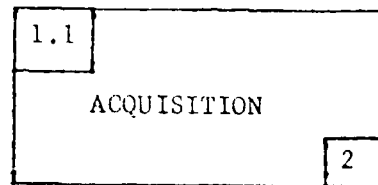
d) WBS numbers and block titles at level III can be selected by the user (except for as previously noted).



e) Block numbers at Level III are restricted to the following values:

Level III blocks under the Level I block 1.0 can have values between 19 and 100. Level III blocks under the Level I block 2.0 can have values between 118 and 200.

f) Note that forcing the user to go to Level III under the Level II block



requires the creation of additional Level III blocks under 1.1, besides 1.1.1 Collector to handle acquisition costs of other components in the solar system as well as integration and installation costs. See Figure 3 as an illustration. The number of these additional Level III blocks is at the discretion of the user.

Having now been through the rules for constructing the WBS, the WBS for the user's problem should be properly constructed. Each WBS block should have a unique WBS number and block number. The WBS numbers should now be arranged in the classic WBS indented format:

- 1.0 Solar System Life Cycle Cost
  - 1.1 Acquisition
    - 1.1.1 Collector
    - 1.1.2 Other
  - 1.2 Building Modifications
    - 
    - 
    -
- 2.0 Conventional System Life Cycle Cost
  - 2.1 Operations
    - 
    - 
    -

A diagram similar to Figure 3 showing the WBS blocks at each level and their relation to each other should be constructed for the user problem.



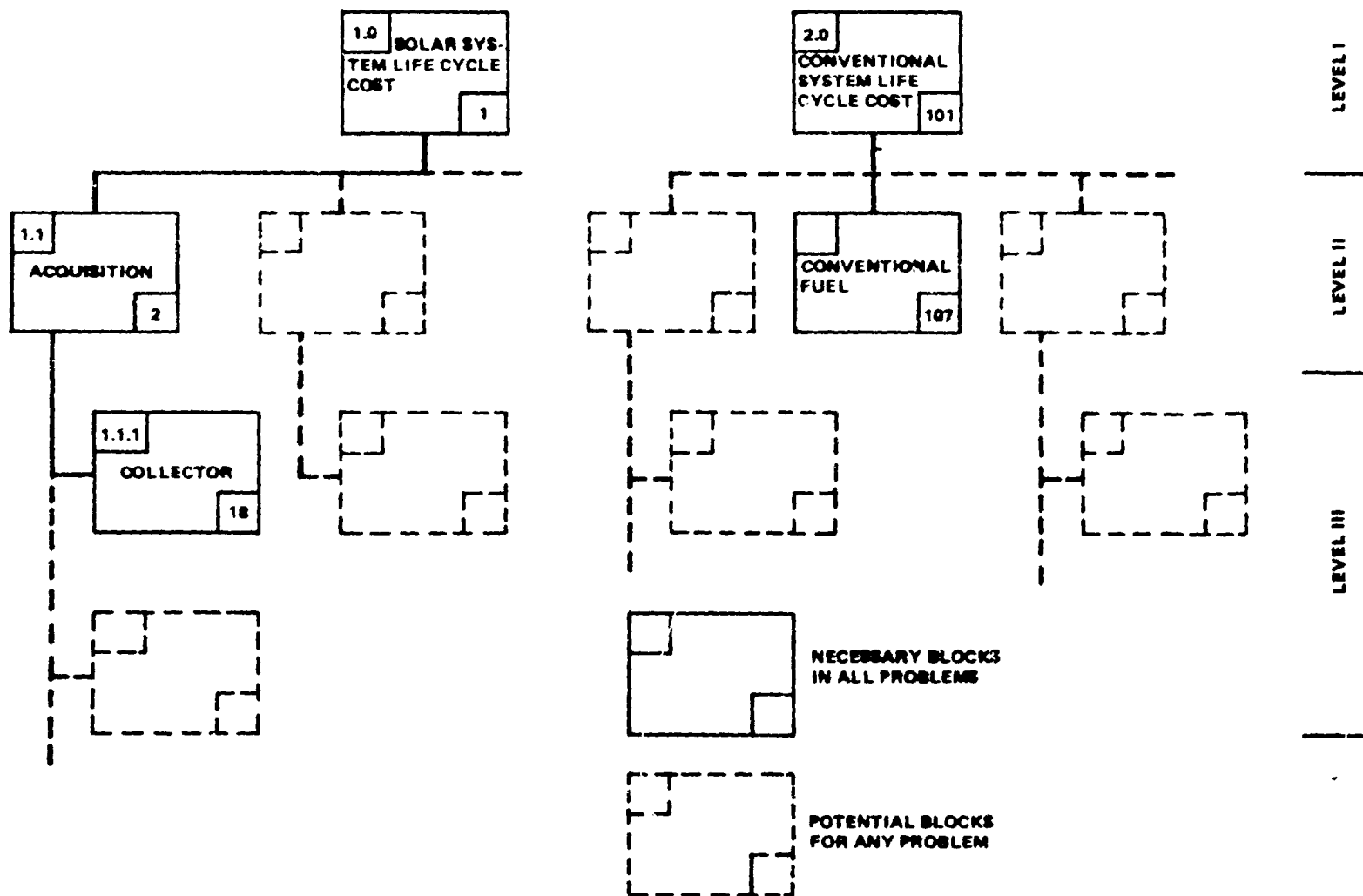


Figure 3. Additional Level III block possibilities.

## B. Data Collection

The next step in formulating the user problem is to gather the necessary cost data and related problem parameters. Data for each selected cost element from Table 1 is required. The additional cost data and problem parameters needed for formulating the complete problem are outlined in Tables 4 and 5. Table 6 indicates the units and format required for all data.

TABLE 4. ADDITIONAL COST DATA WORKSHEET

Additional Cost Data	User Problem Worksheet
Collector cost in dollars/m <sup>2</sup>	
Discount Rate	
Inflation Rate	
Down Payment Rate	
Property Tax Rate	
Income Tax Rate	

TABLE 5. PROBLEM PARAMETER WORKSHEET

Problem Parameters	User Problem Worksheet
Number of years in the life cycle cost analysis	
Starting year	
Collector area, m <sup>2</sup>	
City location code number	
Liquid or Air system	
Total building load, GJ/yr	
Commercial or residential application	

TABLE 6. DATA UNITS AND COMPUTER FORMAT

Cost Data/Problem Parameter	Units	Computer Input Format
Collector Cost	$\$/m^2$	F10.0
Total Building Load	GJ/Yr	F10.0
Discount Rate	Percent (10 percent input as 0.1)	F8.2
Inflation Rate	Percent (6 percent input as 0.06)	F8.2
Downpayment Factor	Percent (10 percent input as 0.1)	F8.2
Property Tax Rate	Percent (2 percent input as 0.02)	F8.2
Income Tax Rate	Percent (30 percent input as 0.3)	F8.2
Collector Area	$m^2$	F8.2
Mortgage Interest Rate	Percent (9 percent input as 0.09)	F8.2

### III. USER PROBLEM SOLUTION

The solution is obtained by inputting the user problem data into the computer in proper format and then executing the program. To begin the process of inputting the problem data, the user should have on hand the following information:

1) The WBS in block diagram form (Fig. 4) with appropriate WBS numbers, block titles and block numbers.

2) The WBS in indented format (Table 7).

3) Cost data for the selected cost elements from Table 1. The blank column in Table 1 is provided so that it can also be used as a problem worksheet.

4) The additional cost data and problem parameters as outlined in Tables 4 and 5. The blank column in Tables 4 and 5 is provided so that it can also be used as a problem worksheet.

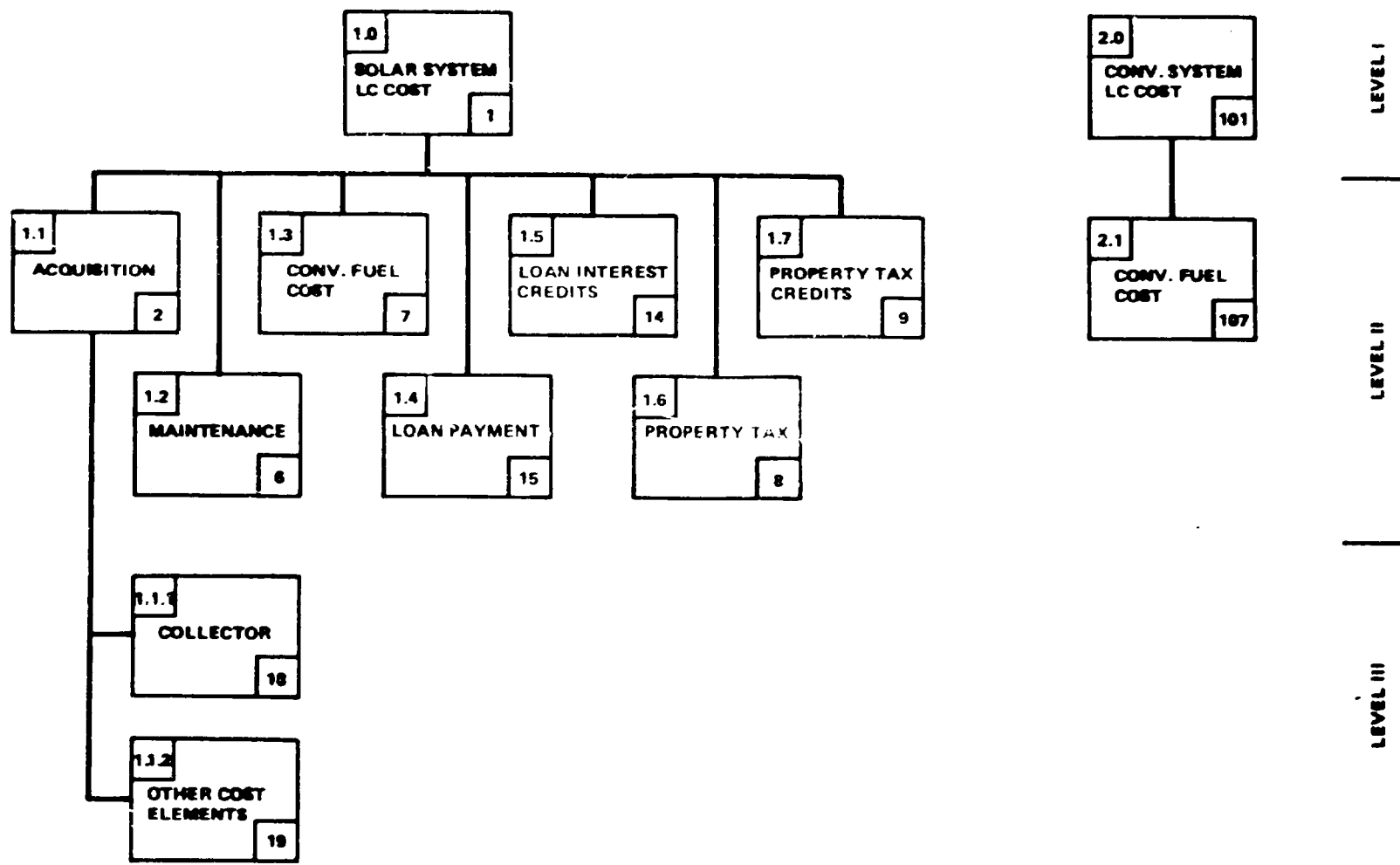


Figure 4. Sample problem WBS structure.

TABLE 7. SAMPLE PROBLEM WBS INDENTURED FORMAT LISTING

1.0	Solar System Life Cycle Cost
1.1	Acquisition
1.1.1	Collector
1.1.2	Other Cost Elements
1.2	Maintenance
1.3	Conventional Fuel Cost
1.4	Loan Payments
1.5	Loan Interest Credits
1.6	Property Tax
1.7	Property Tax Credits
2.0	Conventional System Life Cycle Cost
2.1	Conventional Fuel Cost

All the problem data will now be transferred to user input sheets. User input sheets are in standard 80 column punched card format and are illustrated in Figures 5, 6 and 7. The user input sheets are divided into three sections and the input rules for each will be described. Generally speaking, Section I input defines the WBS structure of the user problem and establishes which cost elements are to be considered in the life cycle cost analysis. Section II defines certain parameters and data values of the user problem. The main data input for each cost element occurs in Section III. Units and computer input format for all data are described in Table 6. The first card in the deck, after the run card, is a title card. Any appropriate descriptive title for the user problem up to 30 characters in length may be used. See Figure 8 for an example of how a complete deck is assembled.

## A. Preparation of Input Data

1. Section I. Section I is illustrated in Figure 5. The first step is to write in the WBS-numbers (in Columns 4-8) and the block titles (in Columns 9-32) using the indentured WBS listing of the user problem as a guide to the proper sequence. There should be one card in Section I for each block in the WBS and they should be in the sequence of the indentured format listing.

BLOCK No.	WBS No.	BLOCK TITLE	BLOCK NUMBERS OF SUBLEVEL BLOCKS															
1	1.0	SOLAR SYS LC COST	2															
2	1.1	ACQUISITION	1.8															
10	1.1.1	COLLECTOR																
		ETC.																
101	2.0	CONV SYS LC COST	10.7															
		ETC.																
107	2. (7)	CONVENTIONAL FUEL																
		ETC.																

Figure 5. User problem input sheet - Section 1.

Figure 6. User problem input sheet - Section II.





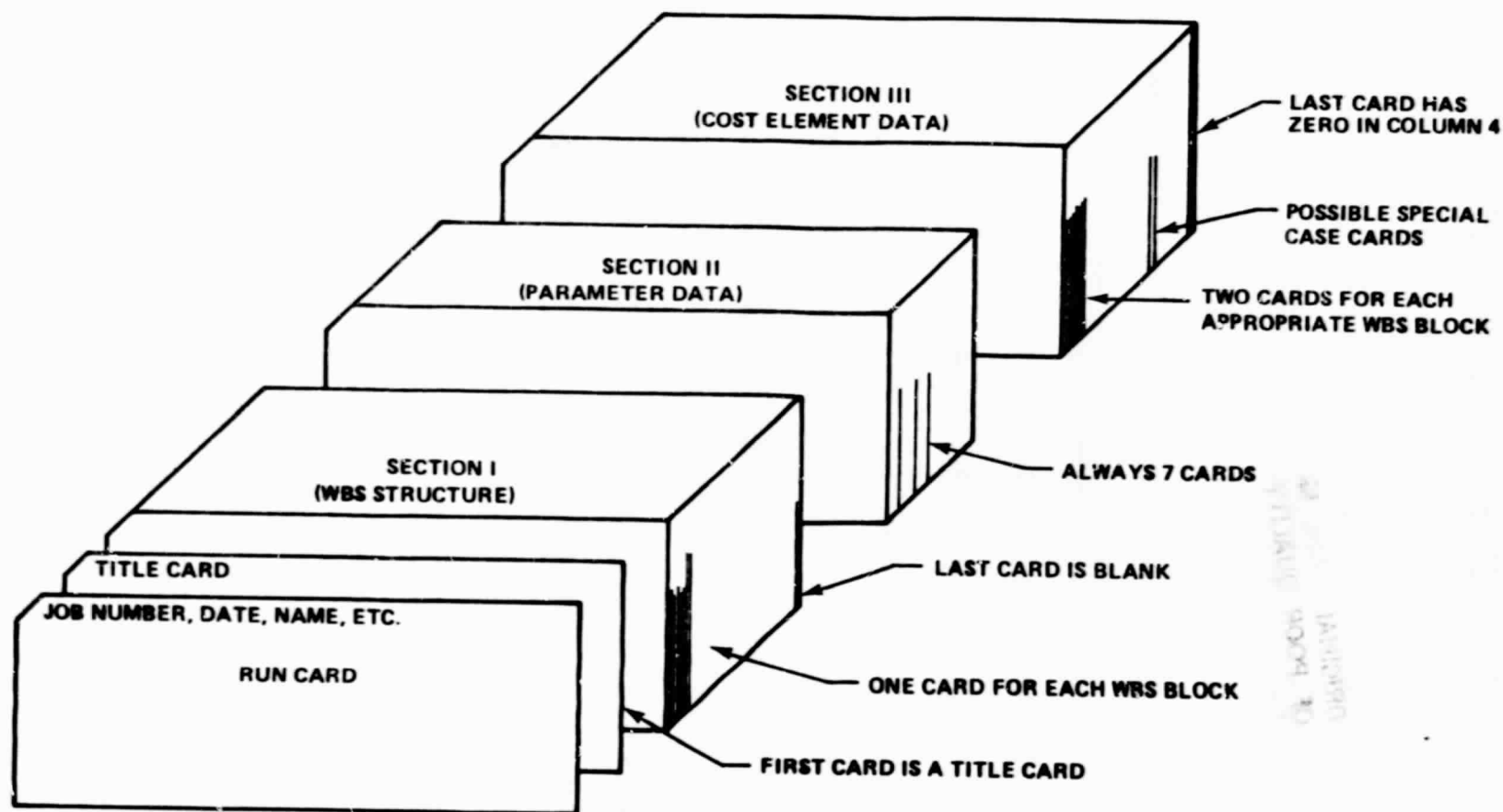


Figure 8. Typical deck setup.

The next step is to write in the block numbers (in Columns 1-3) using the WBS block diagram to obtain block numbers. Note that in Figure 5 five blocks are illustrated. It should be recalled from the discussion of rules for constructing the WBS that these are the 5 blocks that must be a part of every problem. The first three (1.0, 1.1 and 1.1.1) are in the sequence they will always be in for any problem. The proper location of 2.0 and 2.(?) in the sequence will depend on the number of other blocks in the indentured format listing of the user problem.

It is now necessary to insert the block numbers of sublevel blocks in the field of Columns 33-80 for each WBS block. The rules for completing this portion of the input are described in the following paragraphs. The objective of this input is to tell the computer which blocks have lower level blocks under them and for those that do, what the sublevel block numbers are.

Rules for Section I input of block numbers of sublevel blocks are presented in the following paragraphs.

a. Level III Blocks -

1) Since Level III blocks are the lowest in the WBS they have no subblocks. Therefore, no input is appropriate. Leave Columns 33-80 blank on the card for each Level III block in the indentured listing.

b. Level II Blocks -

1) For the Level II blocks which have no Level III blocks under them, simply leave the field blank.

2) For Level II blocks with Level III subblocks, insert each Level III subblock number in the field of Columns 33-80. They do not have to be in any specific sequence. Note that one of the Level III block numbers goes in Columns 33-35, another block number in Columns 36-38, another in 39-41, etc., until all Level III block numbers under that Level II block are listed. Note as an example in Figure 5 that Block Number 18 (a Level III block) is listed as being a sublevel block of Block Number 2, 1.1, Acquisition, itself a Level II block.

c. Level I Blocks -

1) Each of the two Level I blocks (WBS No. 1.0 and 2.0) must have at least one Level II block under it according to our previous discussions and usually there are several other Level II blocks.

2) Insert the Level II block numbers under WBS 1.0 on the card for WBS 1.0 and in the field 33-80. Note that in Figure 5, Block Number 2 is listed.

3) Do not put Level III block numbers on the card of a Level I block, although, in a sense, Level III blocks are sublevels of a Level I block.

4) Insert the Level II block numbers under WBS 2.0 on the card of WBS 2.0 and in the field 33-80. Note in Figure 5 that Block Number 107 is already listed.

There should be as many cards in Section I as there are WBS blocks in the user problem. A blank card should be added as the last card. The input for this section is now complete.

2. Section II. Data for inputting this section comes from Tables 4 and 5. Figure 6 shows how the various data are input. The first card contains the following parameters and data:

a) The number of years in the life cycle cost analysis goes in Columns 1-5.

b) The starting year of the analysis goes in Columns 6-10.

c) The collector cost in  $\$/m^2$  goes in Columns 11-20.

d) Columns 24 and 25 must have "18" in them.

e) The city location code from Table 2 goes in Columns 26-30.

f) For a liquid system insert 1 in Column 35. For an air system insert 2 in Column 35.

g) The total building load in GJ/yr goes in Columns 36-45.

h) For a residential problem input 0 in Column 50. For a commercial problem input 1 in Column 50.

i) The remaining Columns (51-80) should contain the numbers indicated in Figure 3.

The remaining six cards in Section II contain the following data, all inputs beginning in Column 1: discount rate, inflation rate, down payment factor, property tax rate, income tax rate, and collector area. This completes input for Section II.

3. Section III. Figure 7 illustrates the format for Section III input. The purpose of Section III is to input the user problem cost and parameter data for certain WBS blocks. Not all WBS blocks require an input in this section. The WBS blocks of the user problem which require input in this section are identified by the following rules:

- a) Neither of the Level I blocks require data input.
- b) The following Level II blocks, if they happen to be a part of the user problem, do not require input in this section: Block Number 7, Conventional Fuel Cost; Block Number 8, Property Taxes; Block Number 9, Property Tax Credits; Block Number 15, Loan Payments; Block Numbers 16 and 115, Maintenance Expense Credits; Block Numbers 17 and 116, Conventional Fuel Cost Credits.
- c) Every other Level II block requires data input unless it has Level III subblocks.
- d) All Level III blocks require data input except Block Number 18.

Two cards are required to complete the input for each block. The first card contains the block number and the second contains the cost/parameter data. The block card pairs can be grouped in any order; the important point is that the cost-parameter data for each block be on the card immediately following the card containing the block number. The WBS together with these rules should identify the WBS blocks which require cost/parameter data input in Section III. A description of how to input the cost/parameter data on the second card of the block card pair is provided in Table 8. The last portion of the Section III input is for the special case when net replacement and repair has been selected as a cost element in the user problem. In this case, at least two additional cards are required. The first must contain a "5" in Column 4 as illustrated in Figure 7. On the second card, the cost incurred in the first year of the analysis is input in Columns 1 to 8, the cost incurred in the second year of the analysis is input in Columns 9 to 16, those for the third year in 17 to 24, etc. More than this second card may be required to input the data for all years of the analysis, depending on the number of years in the life cycle cost analysis. The very last card of Section III must contain a zero in Column 4.

## B. Program Execution

The program is designed to run on the Univac 1108 with EXEC 8 operating system. The core size is 32k. The program is written in ASC II Fortran and runs in batch mode. A Cal-Comp **plotter** is used for output when a sensitivity run is made and plots are required. Figure 8 shows a typical deck setup with notes that are consistent with the previously discussed rules for inputting the data. Section VI of this report, Program Documentation, contains additional information on program execution.

TABLE 8. SECTION III COST/PARAMETER DATA INPUT

Cost Element	Cost/Parameter Data	Input Description
Building Modifications	Cost in Dollars	Begins in Column 1, F8.2
Acquisition	Cost in Dollars	Begins in Column 1, F8.2
Maintenance	Percent of Acquisition Cost in First Year	Begins in Column 1, F8.2
Conventional Fuel Cost	Cost in Dollars for Supplying 100 Percent of Load and Escalation Rate in Percent	Cost Beginning in Column 1 (F8.2) Followed by Escalation Rate (F8.2)
Depreciation Credit	Salvage Value in Dollars After N Years of Depreciation	Salvage Value Beginning in Column 1 (F8.2) Followed by N (F8.2)
Added Income	Income in Dollars for First Year	Begins in Column 1, F8.2
Insurance	Percent of Acquisition Cost in First Year	Begins in Column 1, F8.2 0. Should be in Columns 10 and 11 and also in Columns 20 and 21.
Salvage	Value in Dollars at End of Period of Analysis	Begins in Column 1, F8.2
Load Interest Credits	Number of Years of Mortgage and Percent Interest Rate	Number of Years Begins in Column 1, (F8.2), Followed by Interest Rate (F8.2).

## IV. SAMPLE PROBLEM

As an example of the formulation and solution of a problem, a sample case is described. This particular problem has been used by the Systems Simulation and Economic Analysis Working Group,<sup>1</sup> a DOE sponsored organization, to compare economic analysis programs nationwide. The sample problem is defined in Table 9. As previously recommended, Tables 1, 4 and 5 have been used as problem worksheets and appear here as Tables 10, 11 and 12. The WBS for the problem is shown in Figure 4 and the WBS indented format listing is in Table 7.

Since no collector area or geographic location is specified, it is necessary to select some values for purposes of executing the program. The \$10,000 initial system cost has been arbitrarily split into \$8,000 for collectors and \$2,000 for other cost elements. In Birmingham, Alabama, a collector area of 48.28 m<sup>2</sup> is necessary to carry 70 percent of the 100 MBtu/yr load. All the information is now available to prepare the computer input sheets. The results of that are shown in Figures 9, 10 and 11. The program was then executed and the problem results are shown in Table 13 and Figure 12.

TABLE 9. SAMPLE PROBLEM DATA

Initial Cost of System	\$10,000
Downpayment	10 percent
Mortgage Rate	9 percent
Discount Rate	10 percent
Maintenance (percent of Initial Cost)	1 percent/yr
Property Tax (percent of Initial Cost)	2 percent
General Inflation Rate	6 percent
Fuel Inflation Rate	10 percent
Effective Tax Rate	30 percent
Initial Fuel Cost	10 \$/MBtu
Load Demand	100 MBtu/yr
Percentage Solar	70 percent
System and Mortgage Lifetime	20 yr
Salvage Value	0

1. "System and Economic Analysis Meeting Report," J. M. Alcone, Sandia Laboratories, Albuquerque, New Mexico, March 4, 1977.

TABLE 10. SAMPLE COST ELEMENTS WORKSHEET

Cost Element	Description	Life Cycle Costing Calculation	User Problem Data Worksheet
Acquisition	Initial costs incurred by purchase, delivery, installation and integration.	Treated as initial, one-time cost and is not discounted or inflated. A down-payment factor may be applied.	\$10,000 total, arbitrarily split into \$8,000 collector and \$2,000 other cost elements.
Building Modifications	Costs due to structural modifications required for the system.	Treated as initial, one-time cost and is not discounted or inflated.	NA
Net Replacement and Repair	Yearly cost of replacements and repair to the system.	Cost input in year incurred, then inflated and discounted.	NA
Maintenance	Estimated annual cost for maintenance of total system.	Initial value input for first year, then inflated and discounted.	1 percent of initial total cost/yr i.e., \$100/yr.
Conventional Fuel Cost	Annual conventional fuel and energy costs required for system operation.	Annual cost for first year input, then inflated by energy escalation factor and discounted.	SOLAR: \$300 first year for conventional fuel. CONVENTIONAL: \$1,000 first year
Property Taxes	Property taxes paid due to assessed value of the equipment.	Same method as for Maintenance.	2 percent of initial cost.
Property Tax Credits	Deductions from income tax due to property taxes paid.	Income tax rate times taxes paid.	To be considered.
Maintenance Expense Credits	Reduces commercial taxable income.	Income tax rate times expenses.	NA
Depreciation Credit	Commercial deduction from taxes.	Straight line method, no inflation.	NA
Added Income	Increased rental of solar compared to conventional property due to lower utilities.	Income is taxed and discounted.	NA
Insurance	Cost of insurance on the system.	Net annual cost input and discounted, not inflated.	NA
Salvage	Expected value at end of life.	Discounted.	0, therefore not considered.
Loan Payments	Annual loan payments on borrowed funds.	Loan is amortized and yearly payment computed. Yearly interest computed. Payment is discounted.	\$9,000 borrowed at 9 percent for 20 years.
Loan Interest Credits	Tax deduction due to interest paid.	Interest from loan computed and discounted.	To be considered.
Conventional Fuel Cost Credit	Commercial tax deduction.	Annual cost for first year input, then inflated by energy escalation factor.	NA

TABLE 11. COST DATA WORKSHEET

Additional Cost Data	User Problem Worksheet
Collector cost in dollars/m <sup>2</sup>	\$8,000/48.28 m <sup>2</sup> = \$165.70/m <sup>2</sup>
Discount Rate	10 percent
Inflation Rate	6 percent
Down Payment Rate	10 percent
Property Tax Rate	2 percent of Initial Cost
Income Tax Rate	30 percent

TABLE 12. PROBLEM PARAMETERS SAMPLE WORKSHEET

Problem Parameters	User Problem Worksheet
Number of years in the life cycle cost analysis	20 years
Starting year	1980
Collector area, m <sup>2</sup>	48.28 m <sup>2</sup>
City location code number	16, Birmingham, Alabama
Liquid or Air system	Liquid
Total building load, GJ/yr	100 MBtu/yr = 105.6 GJ/yr
Commercial or Residential application	Residential

For this sample problem, it is cost effective to install a solar heating system. A life cycle cost savings of \$2,915.18 is achieved. A cash flow diagram of actual yearly costs is shown in Figure 12. Positive savings are first realized in 1983 and "payback" occurs in 1987. The computer printout for the sample problem is also presented in Appendix A. Superimposed on the computer printout are notes explaining various output values.

## V. PROGRAM FLEXIBILITY

The previous discussion of how to formulate and solve a user problem, together with the sample problem described, is intended to develop in the user a basic understanding of how to use the program. The program has been designed with the flexibility to solve a wide range of specific problems in evaluating economic feasibility. In this section those features of the program are described.



BLOCK No.	WBS No.	BLOCK TITLE	BLOCK NUMBERS OF SUBLEVEL BLOCKS														
1	1.0	SOLAR SYSTEM LC COST	2	6	7	15	14	8	9								
2	1.1	ACQUISITION	18	19													
18	1.1.1	COLLECTOR															
19	1.1.2	OTHER COST ELEMENTS															
6	1.2	MAINTENANCE															
7	1.3	CONV FUEL COST															
15	1.4	LOAN PAYMENTS															
14	1.5	LOAN INTEREST CREDITS															
8	1.6	PROPERTY TAXES															
9	1.7	PROPERTY TAX CREDITS															
10	12.0	CONV SYSTEM LC COST	107														
107	12.1	CONV FUEL COST															

Figure 9. User problem input sheet - Section I sample problem.

No. Yrs.	START YEAR	COLLECTOR COST		LOCATION	LIQUID OR AIR	TOTAL LOAD GJ/YEAR	COMM. OR RESID.	INPUT LIST	REAL OR MARKET	LIFE CYCLE SAVINGS	WHEN INFLATE	PLOTS	
20	1980	165.70	18	16	1	105.6	0	0	0	1	0	0	

0.1  
0.08  
0.1  
0.02  
0.3  
48.28

DISCOUNT RATE  
INFLATION RATE  
DOWN PAYMENT FACTOR  
PROPERTY TAX RATE  
INCOME TAX RATE  
COLLECTOR AREA

ORIGINAL PAGE IS  
OF POOR QUALITY

Figure 10. User problem input sheet - Section II sample problem.

### COST ELEMENT DATA INPUT

6		BLOCK NUMBER
. 0 1		COST DATA
1 9		BLOCK NUMBER
4 0 0 0 . 0		COST DATA
1 0 7		
1 0 0 0 . 0	. 1	
1 4		
2 0 .	. 0 9	ETC.

6					ETC.	} SPECIAL CASE INPUT
0						

LAST CARD

Figure 11. User problem input sheet - Section III sample problem.

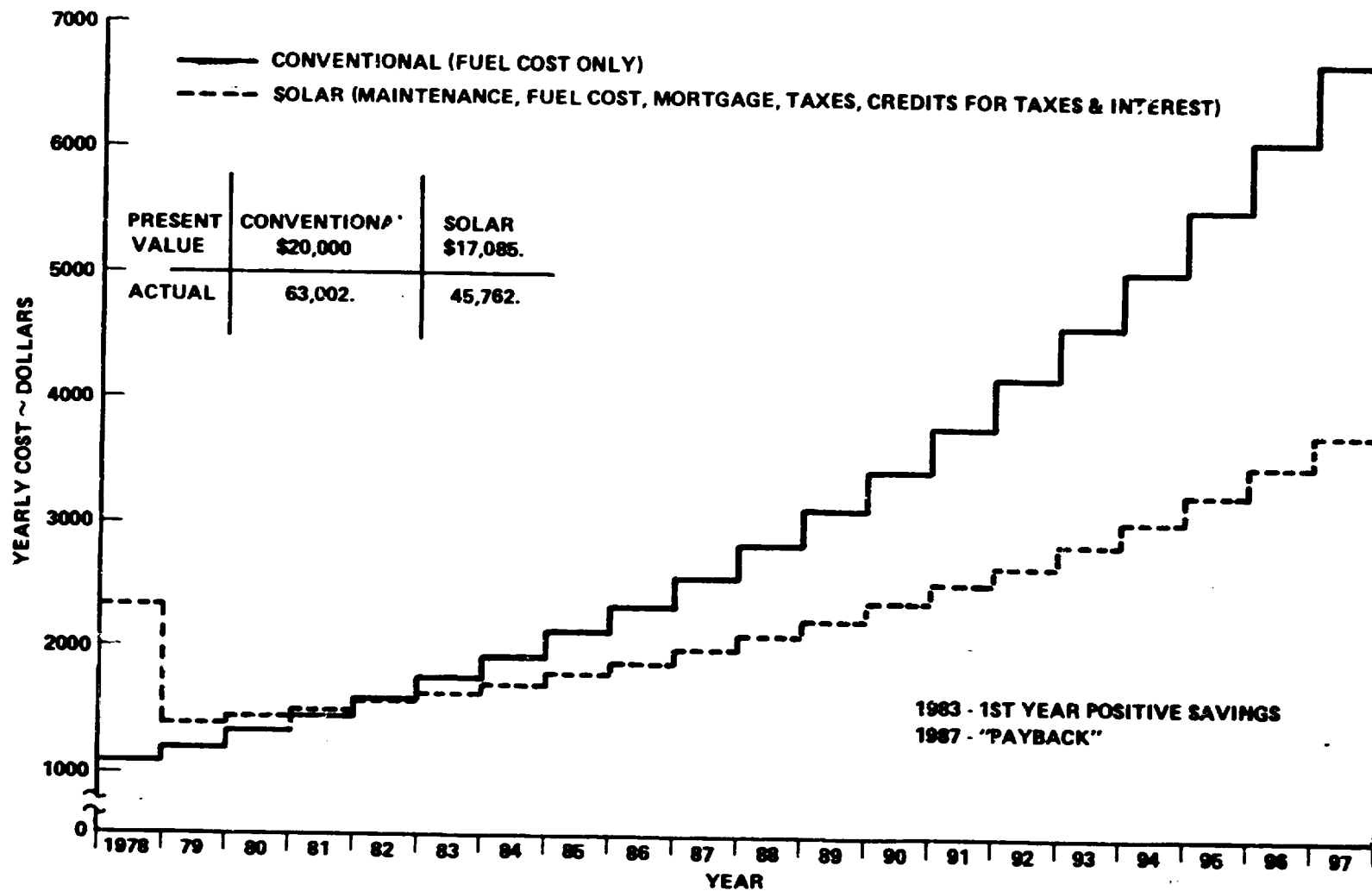


Figure 12. Sample problem cash flow.

TABLE 13. SAMPLE PROBLEM RESULTS

<u>Solar System Life Cycle Costs</u>	
	<u>Present Values</u>
Mortgage	\$ 8,393.69
Property Tax	2,773.38
Maintenance	1,386.69
Downpayment	1,000.00
Conventional Fuel	6,000.00
<u>Tax Credits</u>	
Property Tax	\$ -832.01
Interest	<u>\$-1,637.07</u>
Total Cost	\$17,084.68
<u>Conventional System Life Cycle Cost</u>	
Conventional Fuel	<u>\$20,000.00</u>
Total Cost	\$20,000.00
Life Cycle Savings	\$ 2,915.32
( $\$20,000 - \$17,084.68$ )	
Conventional Fuel Savings	\$14,000.00

### A. Sensitivity Studies

In the discussion of Section II data input, six cards are described which contain the data input for: discount rate, inflation rate, down payment factor, property tax rate, income tax rate and collector area. To study the sensitivity of life cycle cost to any of these parameters, it is only necessary to list on each of these cards the starting value of the parameter, the ending value, then the increment by which the beginning value is increased in steps up to the ending value. A dash (-) separates the starting and ending values and an "X" separates the ending value and the increment. For example, to study in the sample problem the sensitivity of life cycle cost to collector area variations from 30 m<sup>2</sup> to 60 m<sup>2</sup> in increments of 5 m<sup>2</sup> the card should read "30.-60.X5." rather than "48.28" as in the sample problem. The summary output table will now contain the results of all seven cases. Table 14 is an example.

TABLE 14. SUMMARY OUTPUT TABLE

SAMPLE PROBLEM				BIRMINGHAM, ALABAMA				OCT. 2, 1979				16.0-100			
SUMMARY															
BIRMINGHAM, ALABAMA															
DISCOUNT RATE = 10.00%															
INFLATION RATE = 6.00%															
DOWNPAYMENT = 10.00%															
PROPERTY TAX RATE = 2.00%															
INCOME TAX RATE = 30.00%															
COST PER SQ. METER \$165.73															
FOR THIS CASE, VARY IS THE COLLECTOR AREA. GJ/YR															
ECT NO	VARY	PERCENT LOAD	TOTAL LOAD	ACTUAL SHVAC	COST CHVAC	PRESENT SHVAC	VAL COST CHVAC	LIFE CYCLE COST PRESENT	COST ACTUAL	SAVINGS ANNUAL	LIFE CYCLE FUEL PRESENT	ACTUAL	COST ANNUAL		
1	30.0	61.07%	66.04	40292.11	63002.49	17445.50	20000.00	2006.02	14710.38	339.00	10613.95	33435.27	1246.71		
2	35.0	58.52%	61.80	47005.02	63002.49	16941.90	20000.00	3058.10	15917.47	359.70	11703.60	36067.00	1374.73		
3	40.0	63.31%	66.85	46294.13	63002.49	16902.73	20000.00	3097.27	16700.36	363.00	12661.13	39004.13	1407.17		
4	45.0	67.52%	71.30	45067.05	63002.49	16979.06	20000.00	3020.94	17135.44	354.04	13503.17	42536.66	1506.09		
5	50.0	71.22%	75.21	45758.20	63002.49	17166.41	20000.00	2043.59	17244.29	334.01	14244.18	44070.96	1673.12		
6	55.0	74.40%	78.65	45927.90	63002.49	17422.10	20000.00	2577.02	17074.59	302.79	14896.77	46926.69	1749.77		
7	60.0	77.36%	81.69	46341.61	63002.49	17765.42	20000.00	2234.60	16660.00	262.47	15471.90	48730.43	1817.32		

## B. Plot Capability

An x-y coordinate system plot capability is provided to display the results of a sensitivity study. In the Section II data input shown in Figure 6, there is a zero in Column 75. This indicates no plot is desired. When a sensitivity study is done for one of the six variables just described, then plots may be desired. Table 15 defines what plots result from inserting either a 1, 2 or 3 in place of the zero in Column 75. Figures 13 and 14 are examples of plots for the sample problem with collector area as the sensitivity parameter. Only one of the six sensitivity variables can be plotted in a single execution of the program.

## C. Listing of Input Data

If a listing of the input data is not required, insert a "1" in Column 55 of the first card in Section II. See Section III.A.2. for the discussion of inputting the first card in Section II.

## D. Life Cycle Savings

Life cycle savings will not be computed if a zero is inserted in Column 65 of the first card of Section II input.

## E. When to Inflate

Costs in the first year of the analysis will not be inflated if a "1" is input in Column 70 of the first card of Section II input. Normally, i.e., with a zero in Column 70, first year costs are inflated. Whether or not first year costs are inflated is a matter of convention.

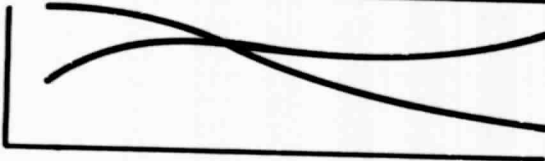
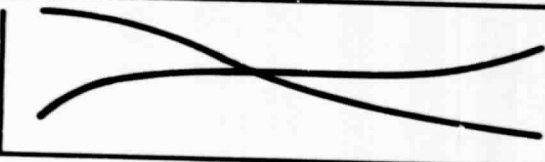
## F. Tax Credits for Energy Conservation

Federal and State tax credits for energy conservation effectively reduce initial system cost. Therefore, in the user problem, the amount of credit can be deducted from acquisition cost before input to the program.

## G. Collector Performance Parameters

The user may desire to use different values of  $F'_{R\tau\alpha}$  and  $F'_{RUL}$  in the GFL method or the percent solar fraction may be known. To use different collector performance parameters, it is necessary to insert one

TABLE 15. PLOT RESULTS FOR 0, 1, 2, AND 3 IN COLUMN 75

Value in Column 75	Plot Obtained
0	No Plots
1	<div> <div>Actual Cost</div>  <div>Sensitivity Variable</div> <div>Solar System</div> <div>Conventional System</div> </div>
2	<div> <div>Present Value Cost</div>  <div>Sensitivity Variable</div> <div>Solar System</div> <div>Conventional System</div> </div>
3	Plots of both actual cost and present value cost, i.e., equivalent to "1" and "2"



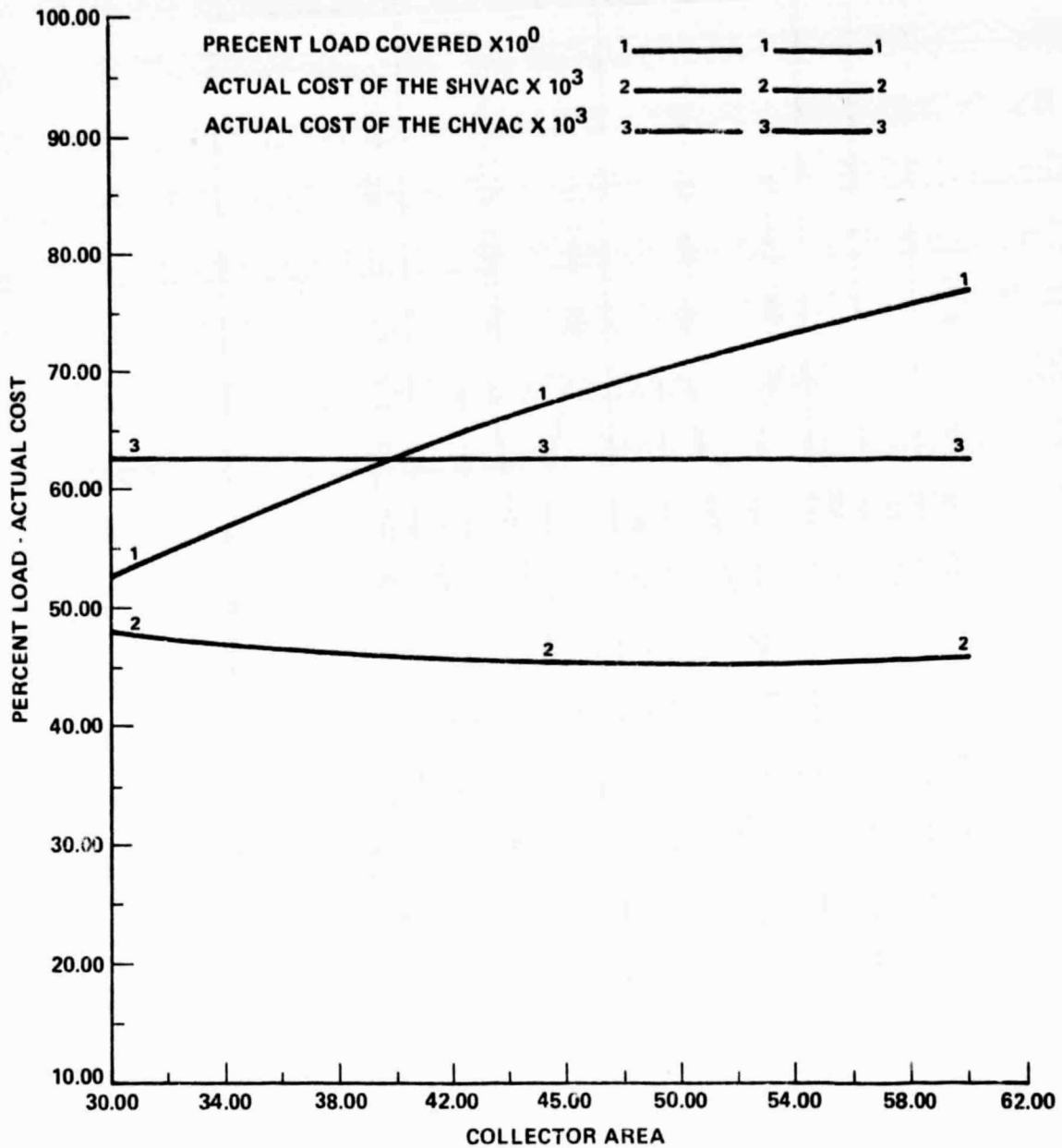


Figure 13. Performance and cost as related to collector area.

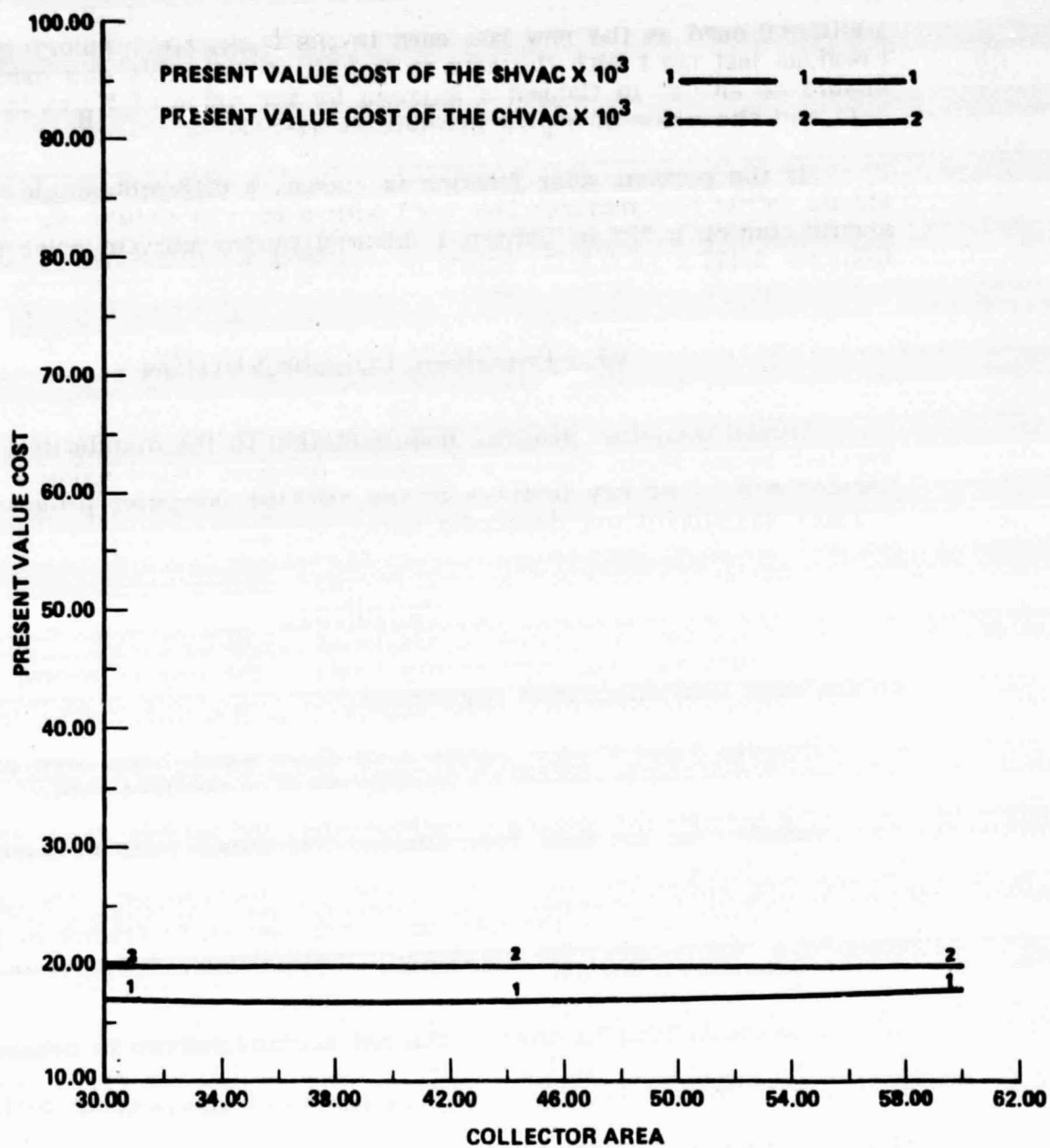


Figure 14. Present value cost as related to collector area.

additional card as the new last card in the deck, i.e., following the previous last card with the zero in Column 4. On this new card there should be an "F" in Column 1 followed by the value of  $F'_{R\tau\alpha}$  in Columns 2-11 and the value of  $F'_{R U_L}$  in Columns 12-21.

If the percent solar fraction is known, a different single new card should follow the previous last card with a zero in Column 4. This card should contain a "P" in Column 1 followed by the percent solar in Columns 2-11.

## VI. PROGRAM DOCUMENTATION

Formal computer program documentation to the standards of the Marshall Space Flight Center's Computer Services Office exists in Reference 8. The key features of the SHCOST computer program from a user's standpoint are described here.

### A. Definitions

Discount Rate (or Opportunity Cost) — the rate of return foregone on the next best alternative investment.

Present Value Cost — future cash flows which have been converted to present day dollar values by application of a discount rate.

Actual Cost (or Real Year Cost) — the dollar value of a cost at the time it is incurred.

Life Cycle Cost — the total of all relevant costs (either in present value of actual dollars) for acquisition, maintenance, and operation of a system over its useful life.

Life Cycle Cost Savings — the net savings (either in present value or actual dollars) obtained by operating a solar heating system rather than a conventional system during the period of analysis; or mathematically, the life cycle cost of the conventional system minus the life cycle cost of the solar system.

### B. Equations

The following terms may apply to either the solar heating system or the conventional system, depending on the user problem. The basic mathematical expression for present value (PV) is defined.

### Acquisition

$$PV = I$$

where

$I$  = initial acquisition cost incurred for purchase, delivery, integration and installation of the system. With debt financing  $I$  becomes simply the downpayment.

### Building Modifications

$$PV = BM$$

where

$BM$  = initial, one-time cost for building modifications.

### Net Replacement and Repair

$$PV = \sum_{j=1}^N \frac{NRR_j}{(1+d)^j}$$

where

$NRR_j$  = net replacement and repair cost in year  $j$ .

$j$  = 1 for first year of analysis and  $j = N$  for last year

$N$  = period of analysis in years

$d$  = annual discount rate

### Maintenance

$$PV_M = M \sum_{j=1}^N \left( \frac{1+i}{1+d} \right)^j$$

where

$M$  = maintenance cost in the first year of system life

$i$  = general inflation rate

### Conventional Fuel Cost

$$PV_{CFC} = F \sum_{j=1}^N \left( \frac{1+e}{1+d} \right)^j$$

where

F = conventional fuel cost in the first year

e = conventional fuel price escalation rate

### Property Taxes

$$PV_{PT} = tI \sum_{j=1}^N \left( \frac{1+i}{1+d} \right)^j$$

where

I = initial total system acquisition cost

t = property tax rate which when multiplied by I gives first year taxes

### Added Income

$$PV = -(1-\bar{t})Y \frac{(1+d)^N - 1}{d(1+d)^N}$$

where

$\bar{t}$  = income tax rate

Y = annual gross revenue

### Insurance

$$PV = P \frac{(1+d)^N - 1}{d(1+d)^N}$$

where

P = first year insurance premium

### Salvage

$$PV = - \frac{S}{(1+d)^N}$$

where

S = salvage value of system at end of period of analysis

### Loan Payments

$$PV = PMT \frac{(1+d)^N - 1}{d(1+d)^N}$$

where

PMT = yearly mortgage payment

### Property Tax Credits

$$PV = - PV_{PT} \bar{t}$$

where

PV<sub>PT</sub> = present value of property taxes

### Maintenance Expense Credits

$$PV = - PV_M \bar{t}$$

where

PV<sub>M</sub> = present value of maintenance expenses

### Depreciation Credit

$$PV = \bar{t} \frac{(I-S)}{N} \frac{(1+d)^N - 1}{d(1+d)^N}$$

### Loan Interest Credit

$$PV = \bar{t} \sum_{j=1}^N \frac{MB_j \ell}{(1+d)^j}$$

where

$$MB_j \text{ (mortgage balance)} = MB_{j-1} - (PMT - MB_{j-1} \ell)$$

$\ell$  = loan interest rate

#### Conventional Fuel Cost Credit

$$PV = - PV_{CFC} \bar{t}$$

where

$PV_{CFC}$  = present value of conventional fuel cost

### C. Flow Chart

A flow chart of the program is presented in Figure 15 and a brief description of the function of each subroutine follows Figure 15.

### D. Listing

A complete program listing is presented in Appendix B.

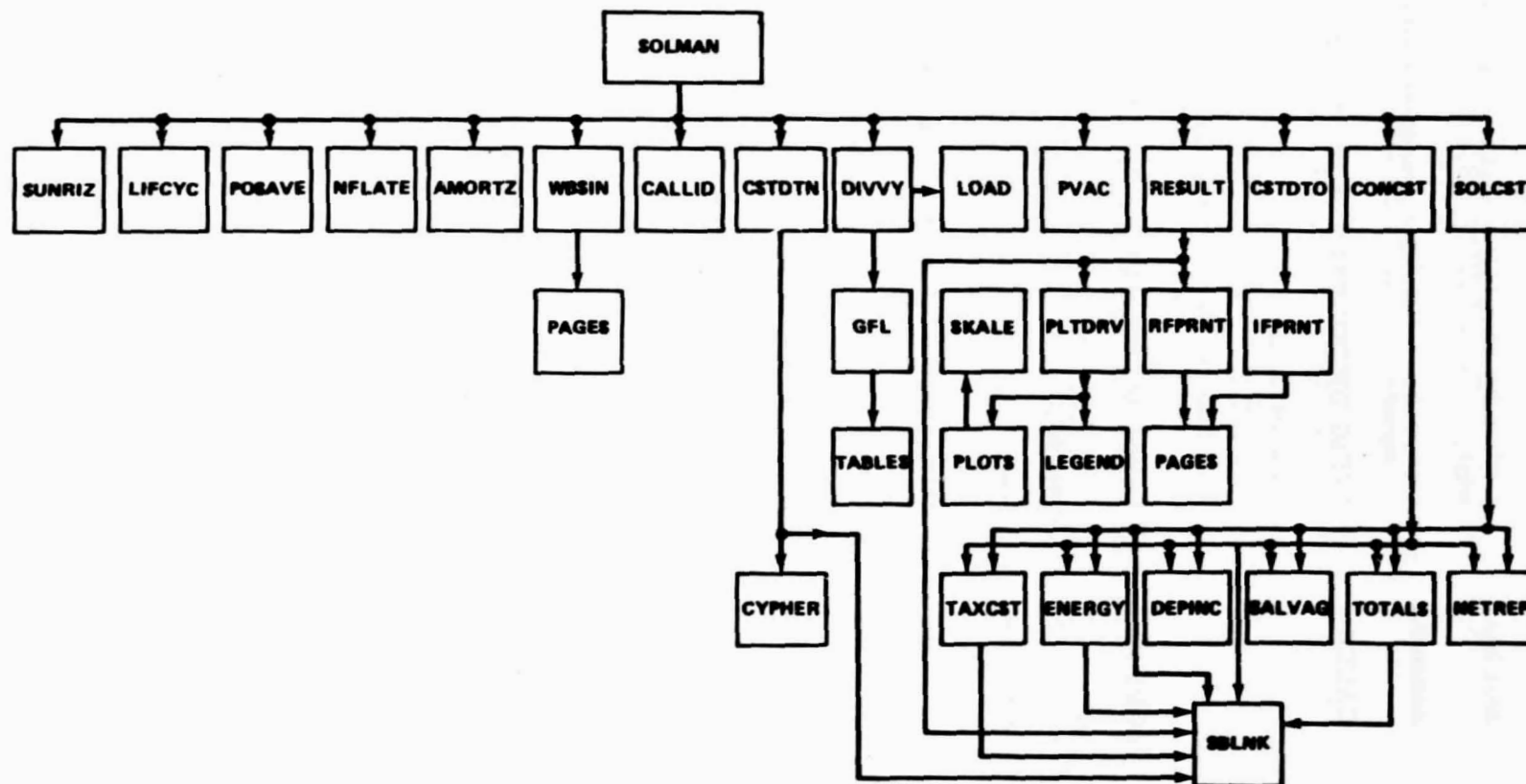


Figure 15. SHCOST flow chart.



ACCNO	Called by CALLID. Gets runs account number for plot.
AMORTZ	Called by SOLMAN. Computes the annual load payment.
CALLID	Called by SOLMAN. Calls system routine projid to get the run's project ID and accno to get the run's account number.
CONCST	Called by SOLMAN. Calls SBLNK, DEPINC, SALVAG, TOTALS NETREP, ENERGY and TAXCST. Computes cost for conventional system.
CSTDTN	Called by SOLMAN, calls CYPHER. Reads cost inputs.
CSTDTO	Called by SOLMAN, calls IFPRNT. Displays cost inputs.
CYPHER	Called by CSTDTN. Reads and decodes cost inputs.
DEPINC	Called by CONCST and SOLCST. Computes deduction for commercial owner. Depreciation, rental, operation expenses and maintenance figure in computations.
DIVVY	Called by SOLMAN. Calls GFL and LOAD. Initiates each case computation.
ENERGY	Called by CONCST and SOLCST. Computes energy cost. Cost for each type of fuel or energy source per year are escalated here.
LIFCYC	Called by SOLMAN. Computes life cycle cost.
IFPRNT	Called by CSTDTO. Prints cost inputs.
GFL	Called by DIVVY. Calls TABLE. Sizes solar system.
NETREP	Called by CONCST, SOLCST. Computes net replacement cost and maintenance cost.
LEGEND	Called by PLTDRV. Displays plot labels on CALCOMP.
NFLATE	Called by SOLMAN. Inflates cost input.
PLOTS	Called by PLTDRV, calls SKALE. Plots data, draws grid.
PLTDRV	Called by RESULT, calls PLOTS, LEGEND. Establishes labels for plots.
POSAVE	Called by SOLMAN. Computes which year positive savings will occur and by how much.
PROJID	Called by CALLID to get runs project ID for plot.
PVAC	Called by SOLMAN. Totals yearly results

Figure 15. (Continued)

RESULT	Called by SOLMAN, calls RFPRNT, SBLNK, PLTDRV. Prints calculated results, generates plot data.
RFPRNT	Called by RESULT. Prints result data.
SALVAG	Called by CONCST, SOLCST. Computes SALVAG values.
SBLNK	Called by CONCST, SOLCST, RESULT, PVAC. Clears memory.
SKALE	Called by PLOTS. Scales plot data.
SOLCST	Called by SOLMAN, calls SBLNK, DEPINC, SALVAG, TOTALS, NETREP, ENERGY, TAXCST. Computes cost for solar system.
SOLMAN	Main routine, calls CALLID, WBSIN, CSTDTN, DIVVY, AMORTZ, NFLATE, CSTDTO, LIFCYC, PVAC, RESULT, POSAVE, SUNRIZ, CONCST, SOLCST.
SUNRIZ	Called by SOLMAN. Displays a summary of every case.
TABLE	Called by GFL. Contains data for each sight, liquid and air solar system.
TAXCST	Called by CONCST, SOLCST. Computes total cost result for each year of each cost input, and adds those to total cost.
WBSIN	Called by SOLMAN. Read data for WBS dictionary structure.
LOAD	Called by DIVVY. Loads cost data for storage.

Figure 15. (Concluded)

## VII. REFERENCES

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**APPENDIX A**  
**SAMPLE PROBLEM**



SAMPLE PROBLEM

OC1. 1, 1279

0.0.1

WBS DICTIONARY

1	1.0	SOLAR SYSTEM LC COST
2	1.1	ACQUISITION
18	1.1.1	COLLECTOR
19	1.1.2	OTHER COST ELEMENTS
6	1.2	MAINTENANCE
7	1.3	CONV. FUEL COST
15	1.4	LOAN PAYMENTS
16	1.5	LOAN INTEREST CREDITS
8	1.6	PROPERTY TAXES
9	1.7	PROPERTY TAX CREDITS
101	2.0	CONV. SYSTEM LC COST
107	2.1	CONV. FUEL COST

ORIGINAL PAGE IS  
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SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.1.2

\*\*\*\*\*  
THIS HEATING VENTILATION AND COOLING ANALYSIS  
WILL COVER 20 YEARS BEGINNING WITH 1980 AND  
ENDING WITH 1999  
THE DISCOUNT RATE TO BE APPLIED TO THE ANALYSIS IS --- 10.00%  
THE INFLATION FACTOR TO BE APPLIED TO THE ANALYSIS IS- 6.00%  
\*\*\*\*\*

SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.1.3

LISTING OF COST DATA INPUT

1.0 SOLAR SYSTEM LC COST

- 1.1 ACQUISITION
- 1.2 MAINTENANCE
- 1.3 CONV. FUEL COST
- 1.4 LOAN PAYMENTS
- 1.5 LOAN INTEREST CREDITS
- 1.6 PROPERTY TAXES
- 1.7 PROPERTY TAX CREDITS

1.1 ACQUISITION

1.1.1 COLLECTOR

ANNUAL LOAD = 105.60 GJ/YR  
PERCENT LOAD COVERED = 70.00%  
INITIAL COST = 8000.00

1.1.2 OTHER COST ELEMENTS

INITIAL COST = 2000.00

DOWNPAYMENT WILL BE 10.00% OF TOTAL COST

1.2 MAINTENANCE

COST PER YEAR = 100.00

1.3 CONV. FUEL COST

ANNUAL FUEL COST = 300.01  
ESCALATION FACTOR = 10.00%



## 1.4 LOAN PAYMENTS

MARKET INTEREST RATE = .00%  
ANNUAL PAYMENT = 985.92

## 1.5 LOAN INTEREST CREDITS

MARKET INTEREST RATE = 9.00%  
INCOME TAX RATE = 30.00%

YEAR	OUTSTANDING MORTGAGE VALUE
1980	9000.00
1981	8824.08
1982	8632.33
1983	8423.32
1984	8195.50
1985	7947.18
1986	7676.51
1987	7381.47
1988	7059.89
1989	6709.36
1990	6327.28
1991	5910.82
1992	5456.88
1993	4962.08
1994	4422.75
1995	3834.88
1996	3194.10
1997	2495.65
1998	1734.34
1999	904.51

## 1.6 PROPERTY TAXES

PROPERTY TAX RATE = 2.00%  
ASSESSED VALUE = 10000.00

## 1.7 PROPERTY TAX CREDITS

PROPERTY TAX RATE = 2.00%  
INCOME TAX RATE = 30.00%  
ASSESSED VALUE = 10000.00

SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.1.5

LISTING OF COST DATA INPUT

2.0 CONV. SYSTEM LC COST  
2.1 CONV. FUEL COST

2.1 CONV. FUEL COST

ANNUAL FUEL COST = 1000.00  
ESCALATION FACTOR = 10.00%

\*\*\*\*\*  
1.0 RESULTS FOR SOLAR SYSTEM LC COST1.1 ACQUISITION  
COSTS OVER THE 20 YEARS OF THE ANALYSISTHE DOWN PAYMENT = 1000.01  
10.00% OF THE TOTAL COST1.2 MAINTENANCE  
COSTS OVER THE 20 YEARS OF THE ANALYSIS  
PRESENT VALUE = 1386.69  
ANNUAL COST = 162.88  
ACTUAL COST = 3899.27

## PRESENT VALUE AND ACTUAL COSTS BY YEAR

YEAR	PVCOST	ACTUAL
1980	96.36	106.00
1981	92.86	112.36
1982	89.46	119.10
1983	86.23	126.25
1984	83.09	133.82
1985	80.07	141.85
1986	77.16	150.36
1987	74.35	159.38
1988	71.65	168.95
1989	69.04	179.08
1990	66.53	189.83
1991	64.11	201.22
1992	61.78	213.29
1993	59.54	226.09
1994	57.37	239.66
1995	55.29	254.04
1996	53.28	269.28
1997	51.34	285.43
1998	49.47	302.56
1999	47.67	320.71

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SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.1.7

1.3

CONV. FUEL COST

COSTS OVER THE 20 YEARS OF THE ANALYSIS

PRESENT VALUE = 6000.15

ANNUAL COST = 704.78

ACTUAL COST = 18901.21

PRESENT VALUE AND ACTUAL COSTS BY YEAR

YEAR	PVCOST	ACTUAL
1980	300.01	330.01
1981	300.01	363.01
1982	300.01	399.31
1983	300.01	439.24
1984	300.01	483.16
1985	300.01	531.48
1986	300.01	584.63
1987	300.01	643.09
1988	300.01	707.40
1989	300.01	778.14
1990	300.01	855.96
1991	300.01	941.55
1992	300.01	1035.71
1993	300.01	1139.28
1994	300.01	1253.21
1995	300.01	1378.53
1996	300.01	1516.38
1997	300.01	1668.02
1998	300.01	1834.82
1999	300.01	2018.30

SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.1.8

1.4 LOAN PAYMENTS  
COSTS OVER THE 20 YEARS OF THE ANALYSIS

PRESENT VALUE = 8393.68

ANNUAL COST = 985.92

ACTUAL COST = 19718.36

## PRESENT VALUE AND ACTUAL COSTS BY YEAR

YEAR	PVCOST	ACTUAL
1980	896.29	985.92
1981	814.81	985.92
1982	740.73	985.92
1983	673.40	985.92
1984	612.18	985.92
1985	556.52	985.92
1986	505.93	985.92
1987	459.94	985.92
1988	418.13	985.92
1989	380.11	985.92
1990	345.56	985.92
1991	314.14	985.92
1992	285.59	985.92
1993	259.62	985.92
1994	236.02	985.92
1995	214.56	985.92
1996	195.06	985.92
1997	177.33	985.92
1998	161.21	985.92
1999	146.55	985.92

SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.1.9

1.5 LOAN INTEREST CREDITS  
COSTS OVER THE 20 YEARS OF THE ANALYSIS  
PRESENT VALUE = 1637.07  
ANNUAL COST = 192.29  
ACTUAL COST = 3215.51

## PRESENT VALUE AND ACTUAL COSTS BY YEAR

YEAR	PV COST	ACTUAL
1980	220.91	243.00
1981	196.90	238.25
1982	175.11	233.07
1983	155.34	227.43
1984	137.40	221.28
1985	121.12	214.57
1986	106.36	207.27
1987	92.97	199.30
1988	80.84	190.62
1989	69.84	181.15
1990	59.88	170.84
1991	50.85	159.59
1992	42.68	147.34
1993	35.28	133.98
1994	28.59	119.41
1995	22.53	103.54
1996	17.06	86.24
1997	12.12	67.38
1998	7.66	46.83
1999	3.63	24.42

1.6 PROPERTY TAXES  
COSTS OVER THE 20 YEARS OF THE ANALYSIS  
PRESENT VALUE = 2773.38  
ANNUAL COST = 325.76  
ACTUAL COST = 7798.54

## PRESENT VALUE AND ACTUAL COSTS BY YEAR

YEAR	PVCOST	ACTUAL
1980	192.73	212.00
1981	185.72	224.72
1982	178.97	238.20
1983	172.46	252.50
1984	166.19	267.65
1985	160.14	283.70
1986	154.32	300.73
1987	148.71	318.77
1988	143.30	337.90
1989	138.09	358.17
1990	133.07	379.66
1991	128.23	402.44
1992	123.57	426.59
1993	119.07	452.18
1994	114.74	479.31
1995	110.57	508.07
1996	106.55	538.55
1997	102.68	570.87
1998	98.94	605.12
1999	95.34	641.43

SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.1.11

1.7 PROPERTY TAX CREDITS  
COSTS OVER THE 20 YEARS OF THE ANALYSIS  
PRESENT VALUE = 832.01  
ANNUAL COST = 97.73  
ACTUAL COST = 2339.56

## PRESENT VALUE AND ACTUAL COSTS BY YEAR

YEAR	PV COST	ACTUAL
1980	57.82	63.60
1981	55.72	67.42
1982	53.69	71.46
1983	51.74	75.75
1984	49.86	80.29
1985	48.04	85.11
1986	46.30	90.22
1987	44.61	95.63
1988	42.99	101.37
1989	41.43	107.45
1990	39.92	113.90
1991	38.47	120.73
1992	37.07	127.98
1993	35.72	135.65
1994	34.42	143.79
1995	33.17	152.42
1996	31.97	161.57
1997	30.80	171.26
1998	29.68	181.54
1999	28.60	192.43



## SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.1.12

1.0 SOLAR SYSTEM LC COST  
THE PRESENT VALUE COST OF THE SYSTEM<sup>a</sup> IS-- 17094.82  
THE ANNUALIZED COST OF THE SYSTEM IS----- 2035.78  
THE ACTUAL COST OF THE SYSTEM IS ----- 45762.32  
COSTS BY YEAR

YEAR	PVCOST	ACTUAL
1980	2206.67	2327.34
1981	1140.78	1380.34
1982	1080.30	1438.00
1983	1025.01	1500.72
1984	974.21	1568.98
1985	927.58	1643.27
1986	884.76	1724.15
1987	845.42	1812.23
1988	809.25	1908.18
1989	775.99	2012.71
1990	745.37	2126.63
1991	717.18	2250.80
1992	691.19	2386.19
1993	667.24	2533.84
1994	645.13	2694.88
1995	624.72	2870.59
1996	605.86	3062.32
1997	588.42	3271.59
1998	572.29	3500.05
1999	557.34	3749.51

SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.1.13

\*\*\*\*\*  
2.0 RESULTS FOR CONV. SYSTEM LC COST

2.1

CONV. FUEL COST

COSTS OVER THE 20 YEARS OF THE ANALYSIS

PRESENT VALUE = 20000.00

ANNUAL COST = 2349.19

ACTUAL COST = 63002.49

PRESENT VALUE AND ACTUAL COSTS BY YEAR

YEAR	PVCOST	ACTUAL
1980	1000.00	1100.00
1981	1000.00	1210.00
1982	1000.00	1331.00
1983	1000.00	1464.10
1984	1000.00	1610.51
1985	1000.00	1771.56
1986	1000.00	1948.72
1987	1000.00	2143.59
1988	1000.00	2357.95
1989	1000.00	2593.74
1990	1000.00	2853.12
1991	1000.00	3138.43
1992	1000.00	3452.27
1993	1000.00	3797.50
1994	1000.00	4177.25
1995	1000.00	4594.97
1996	1000.00	5054.47
1997	1000.00	5559.92
1998	1000.00	6115.91
1999	1000.00	6727.50

2.0 CONV. SYSTEM LC COST  
 THE PRESENT VALUE COST OF THE SYSTEM IS-- 20330.00  
 THE ANNUALIZED COST OF THE SYSTEM IS----- 2349.19  
 THE ACTUAL COST OF THE SYSTEM IS ----- 63002.49  
 COSTS BY YEAR

YEAR	PV COST	ACTUAL
1980	1000.00	1100.00
1981	1000.00	1210.00
1982	1000.00	1331.00
1983	1000.00	1464.10
1984	1000.00	1610.51
1985	1000.00	1771.56
1986	1000.00	1948.72
1987	1000.00	2143.59
1988	1000.00	2357.95
1989	1000.00	2593.74
1990	1000.00	2853.12
1991	1000.00	3138.43
1992	1000.00	3452.27
1993	1000.00	3797.50
1994	1000.00	4177.25
1995	1000.00	4594.97
1996	1000.00	5054.47
1997	1000.00	5559.92
1998	1000.00	6115.91
1999	1000.00	6727.50

.....  
 LIFE CYCLE COST SAVINGS

PRESENT	=	2915.10
ACTUAL	=	17243.17
ANNUALIZED	=	342.42
THE PRESENT VALUE FUEL SAVINGS	=	13999.05
THE ACTUAL FUEL SAVINGS	=	44101.28
THE ANNUALIZED FUEL SAVINGS	=	1644.42

\*\*\*\*\*  
IN YEAR 1985 POSITIVE SAVINGS WILL OCCUR BY  
AN AMOUNT OF 25.79 IN TERMS OF PRESENT VALUE DOLLARS  
IN YEAR 1985 POSITIVE SAVINGS WILL OCCUR BY  
AN AMOUNT OF 41.53 IN TERMS OF ACTUAL DOLLARS

CUMULATIVE SAVINGS BY YEAR  
YEAR PRESENT VALUE SAVINGS ACTUAL SAVINGS

1980	-1206.67	-1227.34
1981	-1347.45	-1397.68
1982	-1427.84	-1504.68
1983	-1452.85	-1541.30
1984	-1427.06	-1499.77
1985	-1354.65	-1371.48
1986	-1239.41	-1146.91
1987	-1084.83	-815.56
1988	-894.08	-365.79
1989	-670.07	215.24
1990	-415.44	941.73
1991	-132.62	1829.36
1992	176.19	2895.44
1993	508.95	4159.10
1994	863.82	5641.46
1995	1239.09	7365.85
1996	1633.23	9358.00
1997	2044.80	11646.32
1998	2472.52	14262.18
1999	2915.18	17240.17

SAMPLE PROBLEM

BIRMINGHAM, ALABAMA

OCT. 1, 1979

16.2.16

## SUMMARY

BIRMINGHAM, ALABAMA

DISCOUNT RATE = 10.00%  
 INFLATION RATE = 6.00%  
 DOWNPAYMENT = 10.00%  
 PROPERTY TAX RATE = 2.00%  
 INCOME TAX RATE = 30.00%  
 COST PER SQ. METER \$165.73

FOR THIS CASE, VARY IS THE COLECTOR AREA. GJ/YR

SECT NO	VARY	PERCENT LOAD	TOTAL LOAD	ACTUAL COST		PRESENT VAL COST		LIFE CYCLE COST		SAVINGS ANNUAL	LIFE CYCLE FUEL COST		
				SHVAC	CHVAC	SHVAC	CHVAC	PRESENT	ACTUAL		PRESENT	ACTUAL	ANNUAL
1	48.3	70.00%	73.92	45762.32	63002.39	17084.82	20000.00	2915.18	17240.17	342.42	13999.85	44101.28	1644.4
NORMAL EXIT		CPU:	2436	SUPS:	4	8472	(MILLISECONDS)						

FIN

**APPENDIX B**  
**SOURCE LIST**

[illegible]

### AMDS-P SHCOST SOURCE LIST

APR 15 1979  
FURPUR 27R3AH4 E33 SL73RI 09/28/79 12:59:36

SHCOST SOURCE LIST

DATE 092879

PAGE

1

SHCOST(1).AMORTZ

```

1      SUBROUTINE AMORTZ
2      INCLUDE PARS
3      IF((IRC1+IRC2.EQ.0) GO TO 290
4      READ(8*IRC1,ERR=600) ISUB,CODE,TITLE,COST
5      READ(8*IRC2,ERR=600) ISA,ACODE,ATITLE,ACOST
6      C*** COMPUTE THE AMORTIZED PAYMENTS AND PLACES OUTSTANDING
7      C*** MORTGAGE ON WHICH INTEREST IS PAID IN YEAR (1) IN COST
8          A=COST(1)
9          N=COST(2)+0.5
10         COST(NYR+1)=COST(3)
11         ACOST(NYR+1)=ACOST(3)
12         ACOST(NYR+2)=ACOST(4)
13         COST(NYR+2)=COST(4)
14     C*** COMPUTE ANNUAL PAYMENTS
15         PAY=A*(COST(NYR+1)/(1.0-(1.0+COST(NYR+1))*(-N)))
16         ACOST(1)=PAY
17         DO 100 K=2,NYR
18             ACOST(K)=PAY
19             KK=K-1
20             COST(K)=COST(KK)-(PAY-COST(NYR+1)*COST(KK))
21             IF(COST(K) .LT. 1.0)COST(K)=0.0
22     100 CONTINUE
23     WRITE(8*IRC1,ERR=600) ISUB,CODE,TITLE,COST
24     WRITE(8*IRC2,ERR=600) ISA,ACODE,ATITLE,ACOST
25     290 RETURN
26     600 WRITE(6,601)
27     601 FORMAT(5X,'ERROR IN AMORTZ')
28     RETURN
29     EN)

```

DATA IGNORED - IN CONTROL MODE

APRT,S A-CALLID

FURPUR 27R3AH4

E33 SL73R1 09/28/79 12:58:40



SHCOST SOURCE LIST

DATE 092879

PAGE 2

SHCOST(1).CALLID

```

1      SUBROUTINE CALLID
2      CHARACTER*12 N
3      CHARACTER*4 N1,N2,E,F
4      CALL PLOT(0.0,0.0,-3)
5      CALL PLOT(0.0,10.0,2)
6      CALL PLOT(8.5,10.0,2)
7      CALL PLOT(8.5,0.0,2)
8      CALL PLOT(0.0,0.0,2)
9      CALL PROJID(N)
10     DECODE(12,100,N) N1,N2
11     100  FORMAT(2A6)
12     CALL SYMBOL(2.3,8.0,.286,N1,0.0,6)
13     CALL SYMBOL(5.6,8.0,.286,N2,0.0,6)
14     CALL ACCNO(N)
15     DECODE(12,100,N) N1,N2
16     CALL SYMBOL(2.3,4.0,.286,N1,0.0,6)
17     CALL SYMBOL(5.6,6.0,.286,N2,0.0,6)
18     CALL SCLOCK(N1,N2,E,F)
19     CALL SYMBOL(2.3,4.0,.286,N1,0.0,6)
20     CALL SYMBOL(5.6,4.0,.286,N2,0.0,6)
21     CALL PLOT(13.5,0.0,-3)
22     RETURN
23     END

```

DATA IGNORED - IN CONTROL MODE

@PRT,S A.CONCST

FURPUR 27R3AHQ E33 SL73R1 09/28/79 12:58:00

# SHCOST SOURCE LIST

DATE 092879

PAGE

3

## SHCOST(11).CONCST

```

1      SUBROUTINE CONCST
2      INCLUDE PARS
3      C   COST DRIVER FOR COSTING CONVENTIONAL SYSTEM
4      IRC1=102
5      C*** TOTAL COSTS INTO UPPER LEVEL
6      CALL TOTALS
7      IRC1=103
8      CALL TOTALS
9      IRC1=104
10     CALL TOTALS
11     C   NETREPLACEMENTS
12     IRC1=105
13     IRC2=106
14     CALL NETREP
15     IRC1=107
16     C*** COMPUTE ENERGY COSTS BY YEAR FOR PV AND FOR EACH SUBLEVEL
17     CALL ENERGY
18     IRC1=109
19     IRC2=108
20     IRC3=111
21     IRC4=113
22     IRC5=114
23     C*** COMPUTE COSTS OF TAXES AND DEDUCTIONS FROM TAXES
24     CALL TAXCST
25     IRC1=110
26     IRC2=0
27     C*** COMPUTE DEPRECIATION DEDUCTIONS AND ADDED INCOME
28     IRC3=115
29     IRC4=116
30     IF(ICON.EQ.1) CALL DEPINC
31     IRC1=112
32     C*** COMPUTE SALVAGE VALUE AFTER N YEARS OF ANALYSIS***
33     CALL SALVAG
34     196 IRC1=101
35     C*** ADD ALL SUBLEVELS FOR THE TOTAL PV AND AC
36     CALL PVAC
37     RETURN
38     END

```

DATA IGNORED - IN CONTROL MODE

PRINT S A-CSTDTN

PRINT 27R3AN0

E33 SL73R1 09/28/79 12:58:51

SHCOST(1).CSTDTN

```

1  SUBROUTINE CSTDTN
2  INTEGER CNT
3  COMMON/N=LT/FLATE
4  COMMON/GFL2/ XSTART,XSTOP,XSTEP
5  INTEGER TYPE
6  INCLUDE PARS
7  COMMON/INPUTS/COSTIN(200,3)
8  C READ DATA IN FOR EACH WBS BLOCK WHICH  REQUIRES COST DATA
9  C READ NYR START YEAR AND DISCOUNT RATE
10 C DISCOUNT RATE DISC SHOULD BE INPUT AS DECIMAL FRACTION NOT AS %
11 C ICOM = 1 IF HVACS ARE COMMERCIAL ELSE ICOM = 0
12 C CHECK NYR AGAINST IYR IN PROC PARS BEFORE XOT
13 C DATOPT = 1 FOR COST DATA OUTPUT SUPPRESSION
14 C*** FLATE=INFLATION RATE EXPRESSED AS FRACTION
15 C*** IDISC=0 INDICATES DISCOUNT RATE IS NOMINAL(MARKET) RATE AND
16 C*** DISC WILL HAVE THE INFLATION RATE SUBTRACTED FROM IT
17 C*** IDISC NOT = 0 INDICATES DISC IS REAL RATE
18 C*** INRGY=1 INDICATES ANALYSSI IS COMPARISON OF ENERGY COSTS AND IC1
19 C*** AND IC2 CONTAIN COSTS ALREADY COMPUTED TO BE USED FOR SYSTEM COSTS
20 C*** IN LIFE CYCLE COSTS
21 C*** ILFCY=1 INDICATES LIFE CYCLE COSTS ARE REQUESTED
22 C*** IDISC=1 INDICATES INFLATION RATE IS TO BE APPLIED
23 C*** AFTER THE FIRST YEAR...IDISC/= 1 INDICATE FIRST YEAR INFLATE
24 C***** READ NYR START YEAR DISCOUNT AND INFLATION FACTORS
25 100 CONTINUE
26 READ(5,110) NYR,IYRST,CSTPSH,CLTPRM,LCN,LOA,XLOAD
27 +,ICOM,DATOPT,IDISC,ILFCY,IDISC
28 +,IPLOTS
29 CALL CYPHER(DSSTRT,DSSTOP,DSSTEP)
30 CALL CYPHER(FTSTRT,FTSTOP,FTSTEP)
31 CALL CYPHER(OPSTRT,OPSTOP,OPSTEP)
32 CALL CYPHER(PTSTRT,PTSTOP,PTSTEP)
33 CALL CYPHER(TSTRT,TSTOP,TSTEP)
34 CALL CYPHER(XSTRT,XSTOP,XSTEP)
35 C DS = DISC - DISCOUNT RATE
36 C FT = FLATE - INFLATION RATE
37 C DP = DWNPMY - DOWNPAYMENT
38 110 FORMAT(2I5,F10.0,3I5,F10.0,7I5)
39 IPLTOP=1
40 IF(DSSTEP.NE.0.0) IPLTOP=2
41 IF(FTSTEP.NE.0.0) IPLTOP=3
42 IF(OPSTEP.NE.0.0) IPLTOP=4
43 IF(PTSTEP.NE.0.0) IPLTOP=5
44 IF(TSTEP.NE.0.0) IPLTOP=6
45 IF(NYR.GT. IY) GO TO 32
46 IF (DATOPT .NE. 1) DATOPT = 0
47 C IBLK=BLOCK # OF DATA TO FOLLOW
48 20 CALL SBLNK
49 READ(5,111) IBLK
50 IF(IBLK.EQ.0) GO TO 333
51 NUM=0
52 IF(IBLK.GT.1517.AND.IBLK.LT.IC1.OR.IBLK.GT.IC16) GO TO 1
53 IF(IBLK.GT.109) GO TO 203
54 GO TO (20,1,1,1,24,1,20,20,20,2,1,3,1,2,20,20,20), IBLK
55 200 GO TO (25,1,1,1,24,1,2,25,20,2,3,1,2,25,20,2), IBLK-170

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56      3      NUM=NUM+1
57      2      NUM=NUM+1
58      1      NUM=NUM+1
59      IF(I9LK.EQ.IS5.OR.I9LK.EQ.IC5) GO TO 24
60      READ(5,500) (COSTIN(I9LK,II),II=1,NUM)
61      500    FORMAT(1)
62      GO TO 20
63      24      CONTINUE
64      C*** SET INDEX FOR READING CARD ON FID.0
65      N=1
66      M=10
67      C*** LOOP FOR ICROS NUMBER OF CARDS IN THIS BLOCK
68      MX=((MYR-1)/10)+1
69      DO 30 I=1,MX
70      C*** READ I*TH CARD
71      READ (5,112) (COST(I,J),J=N,M)
72      112    FORMAT(10F8.2)
73      C*** CHANGE INDEX FOR NEXT CARD
74      N=N+1
75      M=M+10
76      30      CONTINUE
77      C*** WRITE DATA ON DIRECT ACCESS
78      ITWO=L1
79      IA=L2
80      READ(8*19LK,ERR=600) ISU9,CODE,TITLE
81      WRITE(8*19LK,ERR=600) ISUM,CODE,TITLE,COST
82      C      READ NEXT BLOCK
83      GOTO 20
84      32      WRITE(6,34)
85      STOP
86      34      FORMAT(1H1,'NUMBER OF YEARS OF ANALYSIS EXCEEDS THE PARAMETER',
87      *' IY. UPDATE IY OR CHANGE THE NUMBER OF YEARS FOR ANALYSIS.',/,
88      *'THIS RUN WAS SELF TERMINATED.',/)
89      111    FORMAT(1)
90      600    WRITE(6,601)
91      601    FORMAT(5X,'ERROR IN CSTDIN')
92      999    CONTINUE
93      RETURN
94      C      DEB03 SUBTRACE,INIT(COST)
95      C      AT 100
96      C      TRACE ON
97      END

```

APRT.S A.CSTDTO

SHCOST(1).CSTOTO

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1      SUBROUTINE CSTOTO
2      INCLUDE PARS
3      COMMON /NFLT/ FLATE
4      COMMON/IP1/IP
5      DIMENSION NIN(17)
6      DATA NIN/2,2,2,2,2,2,3,3,4,4,4,4,4,4,3,4,4/
7      C READS HIGHEST LEVEL AND TRACE THROUGH EACH BRANCH TO COST DATA
8      C*****
9      C*** IF THIS ONLY AN ENERGY ANALYSIS COST DATA
10     C*** FOR THE ENERGY LEVELS IS PRINTED
11     C*****
12     IF(INRGY .NE. 1) GO TO 40
13     IRC1=IS1
14     CALL PAGES(99)
15     CALL PAGES(2)
16     WRITE(6,1008)
17 1008  FORMAT(1X,132(' '))
18     READ(8*IS1,ERR=700) ISUB, CODE, TITLE, COST
19     CALL PAGES(1)
20     WRITE(6,1007) CODE, TITLE
21     IF((COST(1)+COST(2)+COST(3)).EQ.0) GO TO 15
22     CALL PAGES(5)
23     WRITE(6,1009) CODE, TITLE, (COST(L), L=1,3)
24 15    DO 20 II=1,K1
25     IF(ISUB(II) .LE. 9) GO TO 20
26     KL=ISUB(II)
27     IF(KL.GT.110) KL=KL+1
28     NUM=NIN(KL)
29     CALL PAGES(NUM)
30     READ(8*ISUB(II),ERR=700) ISE, CODE, TITLE, COST
31     I=II
32     CALL IFPRNT
33 20    CONTINUE
34     IRC1=IC1
35     READ(8*IC1,ERR=700) ISUB, CODE, TITLE, COST
36     CALL PAGES(1)
37     WRITE(6,1007) CODE, TITLE
38 1007  FORMAT(1X,3X,A5,2X,6A4)
39     IF((COST(1)+COST(2)+COST(3)).LE.0) GO TO 3)
40     CALL PAGES(5)
41     WRITE(6,1009) CODE, TITLE, (COST(L), L=1,3)
42 30    DO 35 II=1,K1
43     IF(ISUB(II).LE.0) GO TO 35
44     READ(8*ISUB(II),ERR=700) ISE, CODE, TITLE, COST
45     I=II
46     CALL IFPRNT
47 35    CONTINUE
48     RETURN
49 700  WRITE(5,601)
50 601  FORMAT(5X,'ERROR IN CSTOTO')
51     RETURN
52 1009  FORMAT(1X,3X,A5,2X,6A4,/,2X,'COST INPUT OF THE SYSTEM',/,
53     +2X,' PRESENT VALUE =',F12.2,/,
54     +2X,' ACTUAL COST   =',F12.2,/,
55     +2X,' ANNUAL COST   =',F12.2)

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56      40      IRC1=IS1
57      C*****
58      C*** HERE IF RUN IS REGULAR ANALYSIS OF SYSTEMS
59      C*****
60          FLAT=FLATE*100.0
61          DSC=DISC*100.0
62      C*** WRITE STANDARD DATA
63          CALL PAGES(99)
64          WRITE(6,115) NYR,1YRST,1YR(NYR),DSC,FLAT
65      C*** WRITE SUBLEVELS
66          50 READ(8*IRC1,ERR=700) ISUB,CODE,TITLE,COST
67          CALL PAGES(99)
68          CALL PAGES(4)
69          WRITE(6,100)
70          CALL PAGES(1)
71          WRITE(6,101) CODE,TITLE
72          DO 60 II=2,K1
73      C*****      WRITE SUBLEVEL CODES AND TITLES*****
74          IF(ISUB(II).LE.0) GO TO 60
75          READ(8*ISUB(II),ERR=700) ISE,CODE,TITLE
76          CALL PAGES(1)
77          WRITE(6,103) CODE,TITLE
78      60 CONTINUE
79      C      NEXT LEVEL
80          DO 600 I=2,K1
81          IF(ISUB(I).LE.0) GO TO 600
82          READ(8*ISUB(I),ERR=700) ISA,CODE,TITLE,COST
83      C*** WRITE CODE TITLE FOR THIS LEVEL
84      C*** DETERMINE TYPE OF DATA
85          KL=ISUB(I)
86          IF(KL.GT.110) KL=KL+1
87          IF(KL.GT.100) KL=KL-100
88          NUM=MIN(KL)+1
89          IF(KL.EQ.5.OR.KL.EQ.14) NUM=NUM+NYR
90          IF(ISA(2).LE.0 .OR. COST(1) .GT. 0) GO TO 550
91          CALL PAGES(4)
92          WRITE(6,102) CODE,TITLE
93          IF(ISUB(I).EQ.IRC1+1.OR.ISUB(I).EQ.IRC1+2.OR.
94          +ISUB(I).EQ.IRC1+3.OR.ISUB(I).EQ. IRC1+5 .OR. ISUB(I) .EQ. IRC1+15)
95          * 30 TO 150
96          IF(ISUB(I).EQ.IRC1+7.OR.
97          +ISUB(I).EQ.IRC1+8.OR.ISUB(I).EQ.IRC1+9.OR.ISUB(I).EQ.IRC1+13
98          +.OR. ISUB(I) .EQ. IRC1+14) GO TO 200
99          IF(ISUB(I).EQ.IRC1+6) GO TO 300
100         IF(ISUB(I).EQ.IRC1+4)GO TO 400
101         GO TO 550
102      C      ACQUISITIONS BLD3 MOOS SPACE
103      C*** SEARCH LOWER LEVELS FOR DATA
104          100      DO 190 J=2,K1
105          IF(ISA(J).LE.0) GO TO 190
106          READ(8*ISA(J),ERR=700) IS9,CODE,TITLE,COST
107          CALL PAGES(NUM+4)
108          WRITE(6,103) CODE,TITLE
109          IF(CLTPRM.EQ.ISA(J)) WRITE(6,152) YLO%D,PCT(IP)
110          IF(CLTPRM.EQ.ISA(J)) CALL PAGES(2)
111          152      FORMAT(52X,'ANNUAL LOAN =' ,F12.2,' GJ/YR',/

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112      +.43X,*PERCENT LOAD COVERED =*,F12.2,*%')
113      IF (ISB(2).GT.0) GOTO 155
114      CALL IFRNT
115      GO TO 170
116      155      DO 180 K=2,K1
117              IF (ISB(K).LE.0) GO TO 180
118              READ(8*ISB(K),ERR=700) ISC, CODE, TITLE,
119      +COST
120      CALL PAGES(NUM)
121      WRITE(6,134) CODE, TITLE
122      CALL IFRNT
123      180      CONTINUE
124      170      CONTINUE
125      DOWNPM=DOWNPRT*100.0
126      CALL PAGES(1)
127      WRITE(6,1109) DOWNPM
128      1109      FORMAT(1X,2X,*DOWNPAYMENT WILL BE *,F10.2,*% OF TOTAL COST')
129      GO TO 600
130      C   THESE HAVE YEARLY COSTS
131      200      DO 220 J=2,K1
132      C*** SEARCH LOWER LEVELS FOR DATA
133      IF (ISA(J).LE.0) GO TO 220
134      READ(8*ISA(J),ERR=700) ISB, CODE, TITLE, COST
135      CALL PAGES(NUM+4)
136      WRITE(6,103) CODE, TITLE
137      IF (ISB(2).GT.0) GO TO 250
138      CALL IFRNT
139      GO TO 220
140      250      DO 280 K=1,K1
141              IF (ISB(K).LE.0) GOTO 280
142              READ(8*ISB(K),ERR=700) ISC, CODE, TITLE,
143      +COST
144      CALL PAGES(NUM)
145      WRITE(6,134) CODE, TITLE
146      CALL IFRNT
147      280      CONTINUE
148      290      CONTINUE
149      GO TO 600
150      C   OPERATIONS COST DATA
151      300      DO 320 J=2,K1
152      C*** READ LOWER LEVELS FOR ANNUAL FUEL COST AND ESCALATION FACTOR
153      IF (ISA(J).LE.0) GO TO 320
154      READ(8*ISA(J),ERR=700) ISB, CODE, TITLE,
155      +COST
156      COST(2)=COST(2)*100.0
157      CALL PAGES(NUM+4)
158      WRITE(6,103) CODE, TITLE
159      WRITE(6,119) COST(1), COST(2)
160      320      CONTINUE
161      GO TO 600
162      400      CONTINUE
163      DO 520 J=2,3
164      C*** READ LOWER LEVELS BY 3 RECORDS AT A TIME TEST FOR DATA
165      C*** PRINT ONES WITH DATA ...USED WITH REPLACEMENTS AND REPAIR
166      J1=J+1
167      J2=J+2

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168      IF(ISA(J).LE.0) GO TO 520
169      CALL PAGES(NUM+4)
170      READ(8*ISA(J),ERR=700) ISE, CODE, TITLE, COST
171      IF(ISA(J1).LE.0) GO TO 410
172      READ(8*ISA(J1),ERR=700) ISE, ACODE, ATITLE, ACOST
173      IF(ISA(J2).LE.0) GO TO 405
174      READ(8*ISA(J2),ERR=700) ISE, 9CODE, 9TITLE, 9COST
175      WRITE(6,120) CODE, (TITLE(KA), KA=1,5), ACODE, (ATITLE(KB), KB=1,5),
176      *9CODE, (9TITLE(KC), KC=1,5),
177      * (IYR(K), COST(K), IYR(K), ACOST(K), IYR(K), BCOST(K), K=1, NYR)
178      GO TO 520
179      CONTINUE
405      WRITE(6,122) CODE, (TITLE(KA), KA=1,5), ACODE, (ATITLE(K9), K9=1,5),
180      * (IYR(K), COST(K), IYR(K), ACOST(K), K=1, NYR)
181      GO TO 520
182      CONTINUE
410      WRITE(6,124) CODE, (TITLE(KA), KA=1,5), (IYR(K), COST(K), K=1, NYR)
184      CONTINUE
520      GO TO 633
186      CALL PAGES(NUM+3)
187      WRITE(6,102) CODE, TITLE
188      CALL IFPRNT
189      CONTINUE
600      IF(IRC1.EQ.1C1) RETURN
190      IRC1=1C1
191      GO TO 50
192      100 FORMAT(1X,132(' '),//,1X,40X,'LISTING OF COST DATA INPUT',//)
193      101 FORMAT(1X,A5,1X,6A4)
194      102 FORMAT(1X,///,2X,A5,1X,6A4)
195      103 FORMAT(1X,4X,A5,1X,6A4)
196      104 FORMAT(1X,6X,A5,1X,6A4)
197      115 FORMAT(1X,132(' '),//,1X,2X,'THIS HEATING VENTILATION AND COOLING',
198      * ANALYSIS',//,
199      * 3X,'WILL COVER ',15,' YEARS BEGINNING WITH',15,' AND',//, 3X,
200      * ENDING WITH',15,'//,3X,'THE DISCOUNT RATE TO BE APPLIED TO ',
201      * THE ANALYSIS IS ---',F12.2,'%',//,3X,'THE INFLATION FACTOR TO BE',
202      * APPLIED TO THE ANALYSIS IS-',F12.2,'%',//,1X,131(' '))
203      119 FORMAT(1X,40X,'ANNUAL FUEL COST =',F12.2,'//,50X,'ESCALATION ',
204      * FACTOR =',2X,F12.2,'%',//)
205      120 FORMAT(1X,/,3(2X,A5,5A4),/,3(3X,'YEAR',10X,'COST',23X),//,
206      * 5(3(2X,15,2X,F12.2,23X),/,/,//)
207      122 FORMAT(1X,/,2(2X,A5,5A4),/,2(3X,'YEAR',10X,'COST',23X),//,
208      * 5(2(2X,15,2X,F12.2,23X),/,/,//)
209      124 FORMAT(1X,/,2X,A5,5A4),/,3X,'YEAR',10X,'COST',//,
210      * 5(2X,15,2X,F12.2,/)
211      END
212
213

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## SHCOST(1).CYPHER

```

1      SUBROUTINE CYPHER(START,STOP,STEP)
2      INTEGER CARD(80),EX,HYPHEN,ZERO,NINE,PERIOD,SPACE,SLASH
3      DATA EX,HYPHEN,ZERO,NINE/0133,055,060,072/
4      DATA PERIOD,SPACE,SLASH/056,040,057/
5      1  CONTINUE
6      READ(5,10) CARD
7      10  FORMAT(80I1)
8      VAR=0.0
9      IFLAG=0
10     START=0.0
11     STOP=9.9
12     STEP=0.0
13     ISIGN=1
14     I=1
15     11  IF(CARD(I).NE.SPACE) GO TO 12
16         I=I+1
17         IF(I.GT.80) GO TO 999
18         GO TO 11
19     12  CONTINUE
20         IF(CARD(I).EQ.HYPHEN) ISIGN =-1
21         IF(CARD(I).EQ.HYPHEN) I=I+1
22         IF(CARD(I).EQ.HYPHEN) GO TO 12
23         IFLAG=IFLAG+1
24     13  IF(CARD(I).EQ.PERIOD) GO TO 14
25         IF(CARD(I).EQ.SPACE) GO TO 19
26         IF(.NOT.(CARD(I).GE.ZERO.AND.CARD(I).LE.NINE)) STOP 'INVALID CARD'
27         VAR=VAR+10.0+FLOAT(CARD(I)-ZERO)
28         I=I+1
29         IF(I.GT.80) GO TO 999
30         GO TO 13
31     14  I=I+1
32         IF(I.GT.80) GO TO 999
33         ICNT=0
34         IFLAG=IFLAG+1
35     15  IF(CARD(I).EQ.HYPHEN.OR.CARD(I).EQ.SPACE.OR.CARD(I).EQ.EX) GO TO 16
36         ICNT=ICNT+1
37         IF(.NOT.(CARD(I).GE.ZERO.AND.CARD(I).LE.NINE)) STOP 'BAD CARD'
38         VAR=VAR+10.0+FLOAT(CARD(I)-ZERO)
39         I=I+1
40         IF(I.GT.80) GO TO 999
41         GO TO 15
42     16  VAR=(VAR+10.0+ICNT)*ISIGN
43         ISIGN=1
44         IF(IFLAG.EQ.2) START=VAR
45         IF(IFLAG.EQ.4) STOP=VAR
46         IF(IFLAG.EQ.6) STEP=VAR
47         IF(IFLAG.EQ.6) GO TO 999
48         VAR=0.0
49     17  IF(CARD(I).NE.SPACE) GO TO 18
50         I=I+1
51         IF(I.GT.80) GO TO 999
52         GO TO 17
53     18  IF(IFLAG.EQ.2.AND.CARD(I).NE.HYPHEN) GO TO 999
54         IF(IFLAG.EQ.4.AND.CARD(I).NE.EX) STOP 'NO X'
55         I=I+1

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56      IF(I.ST.NO) GO TO 999
57      GO TO 11
58      999  RETURN
59      C    DEBUG TRACE,SUBTRACE,INITICARD,VAR,START,STOP,STEP)
60      C    AT 1
61      C    TRACE ON
62      END
    
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SPRT,S A.DEPINC

SHCOST(1),DEPINC

```

1      SUBROUTINE DEPINC
2      INCLUDE PARS
3      COMMON/NFLT/FLATE
4      1      CONTINUE
5      CALL SBLNK
6      C*****
7      C*** ALL COMPUTATIONS IN THIS ROUTINE ARE FOR COMMERCIAL
8      C*** APPLICATIONS ONLY DEPRECIATION DEDUCTS
9      C*** ADDED INCOME DUE TO THE SHVAC SYSTEM IN RENTAL
10     C*** DEDUCTIONS FROM TAXABLE INCOME DUE TO OPERATION EXPENSES
11     C*** AND MAINTENANCE EXPENSES
12     C*****
13     C  COMPUTE DEPRECIATION DEDUCTIONS AND AFTER TAX INCOME
14     IF(IRC1.EQ.0) GO TO 150
15     READ(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST
16     C*** TEST FOR INCOME TAX RATE IF <= 0 ERROR
17     IF(COST(4) .GT. 0.0) GO TO 90
18     C  WRITE(6,310)
19     GO TO 150
20     C  COST(1 THRU NYR)=DEPRECIATION IN YEAR I COST(NYR+1)=TAX RATE
21     C***** COMPUTE STRAIGHT LINE DEPRECIATION*****
22     90  N=COST(3)
23         D=(COST(1)-COST(2))/COST(3)
24         COST(NYR+1)=COST(4)
25         DO 95 J=1,NYR
26             IF(J .LE. N) COST(J)=D
27         95  IF(J.GT.N)COST(J)=0.0
28         DO 100 I=1,NYR
29     C*** TOTAL HOLDS PV BY YEAR , PV , AC
30     C*** COMPUTE PRESENT VAL ACTUAL AND ANNUALIZED COSTS
31     ACTUAL(I)=COST(1)+COST(NYR+1)
32     ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(I)
33     TOTAL(I)=ACTUAL(I)/(1.0+DISC)**I
34     100  TOTAL(NYR+1)=TOTAL(NYR+1)+TOTAL(I)
35     TOTAL(NYR+2)=TOTAL(NYR+1)*ACFACT
36     WRITE(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST,
37     +FLCOST, TOTAL, ACTUAL
38     C  COMPUTE ADDED INCOME
39     150 IF(IRC2 .EQ. 0) GO TO 300
40     CALL SBLNK
41     READ(8*IRC2,ERR=600) ISUB, CODE, TITLE, COST,
42     +FLCOST
43     IF (FLATE .EQ. 0.0) GO TO 250
44     DO 200 I=1,NYR
45         ACTUAL(I)=FLCOST(I)+(1.0-COST(2))
46         ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(I)
47         TOTAL(I)=ACTUAL(I)/(1.0+DISC)**I
48     200  TOTAL(NYR+1)=TOTAL(NYR+1)+TOTAL(I)
49         TOTAL(NYR+2)=TOTAL(NYR+1)*ACFACT
50         GO TO 250
51     C  COST(1)=HVAC ADDED INCOME COST(2)=INCOME TAX RATE
52     250  TOTAL(NYR+2)=(1.0-COST(2))*COST(1)
53         TOTAL(NYR+1)=TOTAL(NYR+2)+NYR/ACFACT
54         DO 260 J=1,NYR
55         ACTUAL(J)=TOTAL(NYR+2)

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56      260  ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(J)
57      290  WRITE(8*IRC2,ERR=600) ISUB, CODE, TITLE, COST,
58            *FLCOST, TOTAL, ACTUAL
59      C***  MAINTENANCE DEDUCTIONS FROM INCOME TAX COMMERCIAL ONLY
60      300  IF(IRC3 .LE. 0) GO TO 500
61          CALL S9LNK
62          READ(8*IRC3,ERR=600) ISUB, CODE, TITLE, COST,
63            *FLCOST
64          DO 350 J=1, NYR
65              IF(FLATE .EQ. 0.0) ACTUAL(J)=COST(1)+COST(2)
66              IF(FLATE.NE. 0.0) ACTUAL(J)=FLCOST(J)+COST(2)
67              TOTAL(J)=ACTUAL(J)/(1.0+DISC)**J
68              TOTAL(NYR+1)=TOTAL(NYR+1)+TOTAL(J)
69              ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(J)
70      350  CONTINUE
71          TOTAL(NYR+2)=TOTAL(NYR+1)+ACFACT
72          WRITE(8*IRC3,ERR=600) ISUB, CODE, TITLE, COST,
73            *FLCOST, TOTAL, ACTUAL
74      500  IF(IRC4 .LE. 0) GO TO 700
75          CALL S9LNK
76      C***  ENERGY DEDUCTS DUE TO OPERATIONS EXPENSES *****
77          READ(8*IRC4,ERR=600) ISUB, CODE, TITLE, COST,
78            *FLCOST
79          DO 550 I=1, NYR
80              II=I+JYDSC
81              ACTUAL(I)=COST(1)+(1.0+COST(2))*II+COST(3)
82              TOTAL(I)=ACTUAL(I)/(1.0+DISC)**I
83              TOTAL(NYR+1)=TOTAL(NYR+1)+TOTAL(I)
84              ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(I)
85      550  CONTINUE
86          TOTAL(NYR+2)=TOTAL(NYR+1)+ACFACT
87          WRITE(8*IRC4,ERR=600) ISUB, CODE, TITLE, COST,
88            *FLCOST, TOTAL, ACTUAL
89          RETURN
90      600  WRITE(6,601)
91      601  FORMAT(5X, 'ERROR IN DEPINC')
92          RETURN
93      C      DEB03 TRACE, SUBTRACE, INIT
94      C      AT 1
95      C      TRACE ON
96          END

```

PRT.S A.DIVVT

SHCOST(1).DIVVY

```

1      SUBROUTINE DIVVY
2      COMMON/NFLT/ FLATE
3      COMMON/FLAG/IFLG
4      COMMON /IP1/ IP
5      INCLUDE PARS
6      COMMON/INPUTS/COSTIN(200,3)
7      C    DSSTRT - DISCOUNT RATE START VALUE
8      C    DSSTOP - DISCOUNT RATE STOP VALUE
9      C    DSSTEP - DISCOUNT RATE STEP VALUE
10     C    FTSTRT - INFLATION RATE START RATE
11     C    FTSTOP - INFLATION RATE STOP VALUE
12     C    FTSTEP - INFLATION RATE STEP VALUE
13     C    DPSTRT - DOWNPAYMENT START VALUE
14     C    DPSTOP - DOWNPAYMENT STOP VALUE
15     C    DPSTEP - DOWNPAYMENT STEP VALUE
16     C    DISC - DISCOUNT RATE
17     C    FLATE - INFLATION RATE
18     C    DWNPMY - DOWNPAYMENT
19
20     900      CONTINUE
21     DO 100 I=1,200
22     IF(COSTIN(I,1).EQ.0.) GO TO 100
23     DO 101 J=1,3
24     101     COST(J)=COSTIN(I,J)
25     READ(8*1) ISUB, CODE, TITLE
26     WRITE(8*1) ISUB, CODE, TITLE, COST, FLCOST, TOTAL, ACTUAL
27     100     CONTINUE
28     IFLG=0
29     IF((IW.NE.0) GO TO 13
30     DISC=DSSTRT
31     FLATE=FTSTRT
32     DWNPMY=DPSTRT
33     TINCOM=TSTRT
34     PTAX=PTSTRT
35     CALL S=L
36     IP=1
37     15     READ(8*CLTPRM) ISUB, CODE, TITLE
38     COST(1)=PRICE(IP)
39     WRITE(8*CLTPRM) ISUB, CODE, TITLE, COST
40     IRC=IS1
41     IRC1=IS2
42     GO TO 5
43     1     IRC=IC1
44     IRC1=IC2
45     5     READ(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST
46     TACO=0
47     IF((ISUB(2).EQ.0) GO TO 10
48     DO 20 I=2,NTR
49     IF((ISUB(I).EQ.0) GO TO 25
50     READ(8*ISUB(I),ERR=600) ISA, CODE, TITLE, COST
51     20     TACO=TACO+COST(I)
52     25     GO TO 30
53     10     TACO=COST(1)
54     30     READ(8*IRC,ERR=600) ISUB
55     DO 35 I=2,NTR

```

```

56      IF (ISUB(1).LE.0.OR.ISUB(1).GT.200) GO TO 43
57      IF (ISUB(1).GE.IS2.AND.ISUB(1).LE.IS5) GO TO 35
58      IF (ISUB(1).GE.IC2.AND.ISUB(1).LE.IC5) GO TO 35
59      READ(8*ISUB(1),ERR=600) ISA,CODE,TITLE,COST
60      IF (ISA(2).NE.0) GO TO 45
61      CALL LOAD(TACO)
62      WRITE(8*ISUB(1),ERR=600) ISA,CODE,TITLE,COST
63      GO TO 35
64      45      DO 50 J=2,NTR
65              IF (ISA(J).EQ.0) GO TO 35
66              READ(8*ISA(J),ERR=600) ISJ,CODE,TITLE,COST
67              CALL LOAD(TACO)
68              50      WRITE(8*ISA(J),ERR=600) ISJ,CODE,TITLE,COST
69              35      CONTINUE
70              40      IF (IRC.EQ.IS1) GO TO 1
71              IW=99
72              RETURN
73              13      IP=IP+1
74              IF (IPLTOP.EQ.1.AND.PRICE(IP+1).EQ.0.OR.IP.GE.24) IFLG=1
75              IF (PRICE(IP).NE.0.O.AND.IP.LE.25) GO TO 15
76              IP=1
77              DISC=DISC+DSSTEP
78              IF (IPLTOP.EQ.2.AND.DISC+DSSTEP.GE.DSSTOP) IFLG=1
79              IF (DISC.LE.DSSTOP.AND.DSSTEP.NE.0) GO TO 15
80              DISC=DSSTRT
81              PTAX=PTAX+PTSTEP
82              IF (IPLTOP.EQ.5.AND.PTAX+PTSTEP.GE.PTSTOP) IFLG=1
83              IF (PTAX.LE.PTSTOP.AND.PTSTEP.NE.0) GO TO 15
84              PTAX=PTSTRT
85              TINCOM=TINCOM+TSTEP
86              IF (IPLTOP.EQ.6.AND.TINCOM+TSTEP.GE.TSTOP) IFLG=1
87              IF (TINCOM.LE.TSTOP.AND.TSTEP.NE.0) GO TO 15
88              TINCOM=TSTART
89              FLATE=FLATE+FTSTEP
90              IF (IPLTOP.EQ.3.AND.FLATE+FTSTEP.GE.FTSTOP) IFLG=1
91              IF (FLATE.LE.FTSTOP.AND.FTSTEP.NE.0) GO TO 15
92              FLATE=FTSTRT
93              DWNPMT=DWNPMT+DPSTEP
94              IF (IPLTOP.EQ.4.AND.DWNPMT+DPSTEP.GE.DPSTOP) IFLG=1
95              IF (DWNPMT.LE.DPSTOP.AND.DPSTEP.NE.0) GO TO 15
96              DISC=-999.0
97              IFLG=1
98              600      RETURN
99              C          DEBUG INIT,SUBTRACE,TRACE
100             C          AT 900
101             C          TRACE ON
102             END

```

SHCOST(1).ENERGY

```

1      SUBROUTINE ENERGY
2      INCLUDE PARS
3      COMMON/NFLT/FLATE
4      C  COMPUTATION OF ENERGY COSTS FOR HVAC
5      C  COSTS FOR EACH TYPE OF FUEL OR ENERGY SOURCE PER YEAR ARE
6      C  ESCALATED. EACH SUBLEVEL CONTAINS ANNUAL ENERGY COST AND THE
7      C  CORRESPONDING ESCALATION FACTOR. TOTALS ARE PLACED IN OPERATIONS
8      C  LEVEL IN TOTAL
9      I  CONTINUE
10     IF(IRC1.EQ.0)GO TO 110
11     CALL SBLNK
12     READ(8*IRC1,ERR=600) ISUB,CODE,ATITLE,COST,
13     +ACOST
14     C*** IF THIS LEVEL IS EMPTY GO ON TO NEXT
15     IF(ISUB(2) .GT. 0) GO TO 40
16     C*** CHECK FOR POSITIVE COSTS
17     IF(COST(1) .LE. 0.0) GO TO 110
18     DO 25 I=1,NYR
19     II=I+JYDSC
20     ACTUAL(I)=COST(1)+(1.0+COST(2))*II
21     TOTAL(I)=ACTUAL(I)/(1.0+DISC)**I
22     ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(I)
23     25 TOTAL(NYR+1)=TOTAL(NYR+1)+TOTAL(I)
24     GO TO 105
25     C*** HERE IF NO SUBLEVELS
26     C*** COMPUTE COSTS IN TERMS OF PRESENT VALUE
27     C  READ EACH FUEL TYPE AND COMPUTE YEARLY COSTS
28     40 DO 100 I=2,K1
29     C*** SUBLEVEL COSTS
30     IF(ISUB(I).LE.0)GOTO 100
31     ISUBI=ISUB(I)
32     READ(8*ISUBI,ERR=610) ISA,ACODE,ATITLE,
33     +ACOST,FLCOST
34     C  COST(1)=FUEL COST , COST(2)= ESCALATION FACTOR
35     DO 65 J=1,NYR
36     JJ=J+JYDSC
37     BCTUAL(J)=ACOST(1)+(1.0+ACOST(2))*JJ
38     ATOTAL(J)=BCTUAL(J)/(1.0+DISC)**J
39     TOTAL(J)=TOTAL(J)+ATOTAL(J)
40     ACTUAL(J)=ACTUAL(J)+BCTUAL(J)
41     ATOTAL(NYR+1)=ATOTAL(NYR+1)+ATOTAL(J)
42     BCTUAL(NYR+1)=BCTUAL(NYR+1)+BCTUAL(J)
43     65 CONTINUE
44     ATOTAL(NYR+2)=ATOTAL(NYR+1)+ACFACT
45     C  ATOTAL ARE FOR THIS SUBLEVEL
46     C*** ADD SUBLEVEL TOTALS TO UPPER LEVEL TOTALS
47     90 WRITE(8*ISUB(I),ERR=600) ISA,ACODE,ATITLE,ACOST,
48     +FLCOST,ATOTAL,BCTUAL
49     TOTAL(NYR+1)=TOTAL(NYR+1)+ATOTAL(NYR+1)
50     ACTUAL(NYR+1)=ACTUAL(NYR+1)+BCTUAL(NYR+1)
51     ATOTAL(NYR+1)=0.0
52     BCTUAL(NYR+1)=0.0
53     100 ATOTAL(NYR+2)=0.0
54     C  TOTAL ARE FOR THE OPERATIONS LEVEL
55     105 TOTAL(NYR+2)=TOTAL(NYR+1)+ACFACT

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56      WRITE(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST,
57      +AFCOST, TOTAL, ACTUAL
58      110 RETURN
59      600 WRITE(6,601)
60      601 FORMAT(5X, 'ERROR IN ENERGY')
61      RETURN
62      C      DEBUG INIT, SUBTRACE, TRACE
63      C      AT 1
64      C      TRACE ON
65      END

```

@PRT.S A.SFL



SHCOST(1).GFL

```

1      SUBROUTINE GFL
2          COMMON/NAM/NAMES
3          COMMON/LAST/PRICEL
4          COMMON/GFL2/SSTART,SSTOP,SSTEP
5          INCLUDE PARS
6          REAL L9,L
7          DIMENSION FRTA0(2),FRTA(2),FRUL(2)
8          CHARACTER*63 NAMES
9          DATA FRTA0,FRTA,FRUL/.50,.75,.60,.75,4.00,4.00/
10         1      CONTINUE
11             I=LCN
12             J=LOR
13             L=XLOAD
14
15             CALL TABLE(I,J,PA,PB,PC,PD,PE,PF,NAMES,L0)
16             K=0
17             AC=SSTART
18             1000 K=K+1
19                 PRICE(K)=AC+CSTPSH*0.0005
20                 AREA(K)=AC
21                 X=(FRUL(J)/FRTA(J))-8.0
22                 Y=(FRTA(J)/FRTA0(J))*(L0/L)*AC
23                 R=PA+PB*X+PC*(X**2)
24                 S=PD+PE*X+PF*(X**2)
25                 EXPNT=(R+Y+S*(Y**2))*(-1)
26                 FPCT=1-EXP(EXPNT)
27                 AC=AC+SSTEP
28                 G(K)=FPCT*L
29                 PCT(K)=FPCT*100.0
30                 IF(AC.LE.SSTOP.AND.K.LT.IS=L)GO TO 1000
31                 PRICEL=PRICE(K)
32                 RETURN
33         C      DEBUG INIT,TRACE,SUBTRACE
34         C      AT 1
35         C      TRACE ON
36             END

```

@PRT,S A.IFPRNT

SHCOST(1),IFPRNT

```

1      SUBROUTINE IFPRNT
2      INCLUDE PARS
3      C   DETERMINE FORMAT AND VARIABLES FOR PRINT
4      IF(ISUB(1).EQ.0) GO TO 100
5      COST(NYR+1)=COST(NYR+1)*100
6      COST(NYR+2)=COST(NYR+2)*100
7      ISWICH=ISUB(1)-1
8      IF(ISWICH.GT.100) GO TO 1
9      GO TO (13,15,15,20,25,30,35,40,45,50,55,60,65,69,85,87),ISWICH
10     1   GO TO (10,15,15,20,25,30,35,40,45,55,60,65,69,85,87),ISWICH-100
11     C   ACQUISITIONS
12     10  CONTINUE
13         WRITE(6,70) COST(1)
14         GO TO 100
15     C   BUILDING MODIFICATIONS
16     C   SPACE OCCUPIED
17     15  CONTINUE
18         WRITE(6,71)COST(1)
19         GO TO 100
20     C   NET REPAIRS AND REPLACEMENTS
21     20  CONTINUE
22         WRITE(6,73)(IYR(K),COST(K),K=1,NYR)
23         GO TO 100
24     C   MAINTENANCE COSTS
25     25  CONTINUE
26         WRITE(6,72) COST(1)
27         GO TO 100
28     C   OPERATIONS COSTS
29     30  COST(2)=COST(2)*100.0
30         WRITE(6,75) COST(1),COST(2)
31         GO TO 100
32     C   PROPERTY TAX COSTS
33     35  COST(2)=COST(2)*100.0
34         WRITE(6,76) COST(2),COST(1)
35         GO TO 100
36     C   PROPERTY TAX DEDUCTIONS
37     40  COST(2)=COST(2)*100.0
38         COST(3)=COST(3)*100.0
39         WRITE(6,77) COST(2),COST(3),COST(1)
40         GO TO 100
41     C   DEPRECIATION DEDUCTIONS
42     45  COST(4)=COST(4)*100.0
43         WRITE(6,78) (COST(K),K=1,4)
44         GO TO 100
45     C   ADDITIONAL AFTER TAX INCOME
46     50  COST(2)=COST(2)*100.0
47         WRITE(6,79)COST(1),COST(2)
48         GO TO 100
49     C   INSURANCE COSTS
50     55  CONTINUE
51         WRITE(6,80) COST(1),COST(2),COST(3)
52         GO TO 100
53     C   SALVAGE VALUE AFTER N YEARS OF ANALYSIS
54     60  CONTINUE
55         WRITE(6,81) COST(1),NYR

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56      GO TO 130
57      C  LOAN MORTGAGE VALUE
58      65  CONTINUE
59          WRITE(6,82) COST(NYR+1),COST(NYR+2),
60          +((IYR(K),COST(K),K=1,NYR)
61      GO TO 100
62      69  CONTINUE
63          WRITE(6,83)COST(NYR+1),COST(1)
64      GO TO 130
65      85  COST(2)=COST(2)+100.0
66          WRITE(6,84)COST(1),COST(2)
67      GO TO 100
68      87  COST(2)=COST(2)+100.0
69          COST(3)=COST(3)+100.0
70          WRITE(6,85)COST(1),COST(2),COST(3)
71      70  FORMAT(1X,50X,'INITIAL COST =',F12.2,/)
72      71  FORMAT(1X,50X,'COST =',F12.2,/)
73      72  FORMAT(1X,50X,' COST PER YEAR = ',F12.2,/)
74      73  FORMAT(1X,50X,'YEAR',10X,'COST',/,50(50X,15.2X,F12.2,/)
75      75  FORMAT(1X,50X,'ANNUAL FUEL COST =',F12.2,/,50X,'ESCALATION ',
76      +,FACTOR =',2X,F10.2,'%',/)
77      76  FORMAT(1X,50X,'PROPERTY TAX RATE =',F10.2,'%',/,51X,
78      +,ASSESSED VALUE =',F10.2)
79      77  FORMAT(1X,50X,'PROPERTY TAX RATE =',F10.2,'%',/,50X,
80      +,INCOME TAX RATE =',F10.2,'%',/,51X,'ASSESSED',
81      +,VALUE =',F10.2)
82      78  FORMAT(1X,50X,'ORIGINAL VALUE',7X,'=',1X,F12.2,/,51X,'SALVAGE ',
83      +,VALUE',9X,'=',F12.2,/,51X,'YEARS OF EXPECTED USE =',F12.2,/,51X,
84      +,INCOME TAX RATE =',3X,F10.2,'%',/)
85      79  FORMAT(1X,50X,'ADDITIONAL ANNUAL INCOME =',F12.2,/,51X,'INCOME ',
86      +,TAX RATE =',11X,F10.2,'%',/)
87      80  FORMAT(1X,50X,'ANNUAL PREMIUMS =',16X,F12.2,/,51X,
88      +,ANNUAL ESTIMATED DAMAGE =',8X,F12.2,/,51X,
89      +,ANNUAL INSURANCE REIMBURSEMENTS =',F12.2,/)
90      91  FORMAT(1X,50X,'SALVAGE VALUE =',F12.2,' AFTER',15,' YEARS',/)
91      82  FORMAT(1X,50X,'MARKET INTEREST RATE =',F10.2,'%',/,51X,
92      +,INCOME TAX RATE =',5X,F10.2,'%',/,51X,'YEAR',3X,'OUTSTANDING ',
93      +,MORTGAGE VALUE',/,50(50X,15.6X,F12.2,/)
94      83  FORMAT(1X,50X,'MARKET INTEREST RATE =',F10.2,'%',/,51X,
95      +,ANNUAL PAYMENT =',5X,F10.2)
96      84  FORMAT(1X,50X,' COST PER YEAR = ',F12.2,/,51X
97      +,INCOME TAX RATE =',2X,F10.2,'%',/)
98      89  FORMAT(1X,50X,'ANNUAL FUEL COST =',1X,F12.2,/,51X,'ESCALATION',
99      +,FACTOR = ',F10.2,'%',/,51X,'INCOME TAX RATE =',4X,F10.2,'%',/)
100     100  RETURN
101     END

```

SHCOST(1).LEGEND

```

1      SUBROUTINE LEGEND(LABELS,IEX,ICODE)
2      CHARACTER*4 LABELS(14)
3      CHARACTER*2 EXP
4          IF(ICODE.NE.1) GO TO 14
5      CALL SYMBOL(3.5,9.0,.143,64,LEGEND,0.0,6)
6      YAXIS=8.0
7      I=0
8          XNUM=0
9      YSTEP=0.2
10      NNUM=0
11      DO 11 J=1,8
12          IF(LABELS(J).EQ.44) GO TO 12
13      NNUM=NNUM+4
14      CONTINUE
15      YAX=YAXIS-(YSTEP*FLOAT(I))
16      I=I+1
17      CALL SYMBOL(0.0,YAX,.143,LABELS,0.0,NNUM)
18      XAX=FLOAT(NNUM)/7.0
19      CALL SYMBOL(XAX,YAX,.143,44 X10.0,3,4)
20      ENCODE(2,13,EXP) IEX
21      FORM(1,1)
22      CALL SYMBOL(XAX+.6,YAX+.125,.072,EXP,0.0,2)
23      XNUM=XNUM+1
24      XAXIS=6.0
25      CALL NUMBER(XAXIS,YAX,.071,XNUM,0.0,-3)
26      DO 10 J=1,2
27          XAXIS=6.0+FLOAT(J)
28          CALL PLOT(XAXIS,YAX,2)
29      CALL NUMBER(XAXIS,YAX,.071,XNUM,J,0,-3)
30      IF(ICODE.EQ.3) CALL PLOT(15.0,0.0,-3)
31      RETURN
32      END

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3PRT,S A.LIFCYC

SHCOST(1),LIFCYC

```

1  SUBROUTINE LIFCYC
2  INCLUDE PARS
3  COMMON/CYL IF/CYLF(6)
4  EQUIVALENCE (CYLIFE,CYLF(1)),(ACYLIF,CYLF(2)),(ANCYLF,CYLF(3)),
5  *(FUSAVE,CYLF(4)),(AFUSAV,CYLF(5)),(ANFUSV,CYLF(6))
6  C*****
7  C***      READ RECORDS FOR TOTAL COSTS OF EACH SYSTEM
8  C***      ISI IS TOP LEVEL FOR SHVAC
9  C***      ICI IS TOP LEVEL FOR CHVAC
10 C*****
11      IF(ISI .NE. 0) READ(8*ISI,ERR=600) ISE,ECODE,ETITLE,COST,ETOTAL,
12      +TOTAL,ACTUAL,PV,AC,ACT
13      IF(ICI .NE. 0) READ(8*ICI,ERR=600) ISE,ECODE,ETITLE,ACOST,ETOTAL,
14      +ATOTAL,BCTUAL,PV1,AC1,ACT1
15 C*****
16 C***      READ ENERGY COSTS FOR SHVAC (IS7) AND FOR CHVAC (IC7)
17 C*****
18      READ(8*IS7,ERR=600) ISE,ECODE,ETITLE,ECOST,ETOTAL,GTOTAL,
19      +CCTUAL
20      READ(8*IC7,ERR=600) ISE,ECODE,ETITLE,ECOST,ETOTAL,CTOTAL,
21      +DCTUAL
22 C*****
23 C***      COMPUTE LIF CYCLE COSTS AND FUEL SAVINGS
24 C*****
25      CYLIFE=PV1-PV
26      ACYLIF=ACT1-ACT
27      ANCYLF=AC1-AC
28 C*****
29 C***      IF ANALYSIS IS COMMERCIAL ENERGY DEDUCTS MUST BE DEDUCTED
30 C***      ELSE ONLY ENERGY COSTS ARE INVOLVED
31 C*****
32      IF(ICOM .EQ. 1) GO TO 100
33      FUSAVE=CTOTAL(NYR+1)-GTOTAL(NYR+1)
34      AFUSAV=DCTUAL(NYR+1)-CCTUAL(NYR+1)
35      ANFUSV=CTOTAL(NYR+2)-GTOTAL(NYR+2)
36 C*****
37 C***      SKIP COMMERCIAL ANALYSIS IF HERE GO TO CHECK FOR
38 C***      ENERGY ANALYSIS ONLY OR REGULAR TYPE
39 C*****
40      GO TO 200
41 C*****
42 C***      READ ENERGY COSTS 2ND ENERGY DEDUCTS FROM IS7 AND IS17
43 C***      DETERMINE NET FUEL COSTS FOR FUEL SAVINGS
44 C*****
45      100 READ(8*IS7,ERR=600) ISE,ECODE,ETITLE,ECOST,ETOTAL,GTOTAL,
46      +CCTUAL
47      READ(8*IS17,ERR=600) ISE,ECODE,ETITLE,ECOST,ETOTAL,CTOTAL,
48      +DCTUAL
49      FUNET1=BTOTAL(NYR+1)-CTOTAL(NYR+1)
50      AFNET1=CCTUAL(NYR+1)-DCTUAL(NYR+1)
51      ANFNT1=BTOTAL(NYR+2)-CTOTAL(NYR+2)
52 C*****
53 C***      READ CHVAC ENERGY COSTS AND ENERGY DEDUCTS
54 C***      DETERMINE FUEL SAVINGS
55 C*****

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56      READ(8*IC7,ERR=600) ISE,ECODE,ETITLE,ECOST,ETOTAL,BTOTAL,
57      *CCTUAL
58      READ(8*IC16,ERR=600) ISE,ECODE,ETITLE,ECOST,ETOTAL,CTOTAL,
59      *DCTUAL
60      FUNET2=BTOTAL(NYR+1)-CTOTAL(NYR+1)
61      AFNET2=CCTUAL(NYR+1)-DCTUAL(NYR+1)
62      ANFNT2=BTOTAL(NYR+2)-CTOTAL(NYR+2)
63      FUSAVE=FUNET2-FUNET1
64      AFUSAV=AFNET2-AFNET1
65      ANFUSV=ANFNT2-ANFNT1
66      C*****
67      C***      IF THIS IS AN ENERGY COSTS ANALYSIS ONLY
68      C***      RECOMPUTE LIFE CYCLE COSTS
69      C***      ELSE GO WRITE RESULTS TO FILE 8
70      C*****
71      200      IF(INR3V.NE.1) GO TO 300
72      CYLIFE=FUSAVE-(COST(1)-ACOST(1))
73      ANCYLF=ANFUSV-(COST(2)-ACOST(2))
74      ACYLF=AFUSAV-(COST(3)-ACOST(3))
75      C*****
76      C***      WRITE THE LIFE CYCLE COSTS OUT TO MASS STORAGE
77      C*****
78      300      READ(8*ILF,ERR=600) ISUB,CODE,TITLE
79      WRITE(8*ILF,ERR=600) ISUB,CODE,TITLE,CYLF
80      RETURN
81      600      WRITE(6,601)
82      601      FORMAT(5X,'ERROR IN LIFE CYC')
83      RETURN
84      END

```

91  
 @PRT.S A.LOAD

SHCOST(1).LOAD

```

1      SUBROUTINE LOAD(TACO)
2      INCLUDE PARS
3      COMMON/IP1/IP
4      IBLK=ISUB(I)
5      IF (IBLK.GT.100) GO TO 100
6      GO TO (9,9,9,9,9,10,9,20,25,30,65,40,9,50,45,55,9), IBLK
7      100  GO TO (9,9,9,9,9,10,15,20,25,30,40,9,50,75,70,60), IBLK-100
8      55  READ(8*IS6,ERR=600) ISD,DCODE,DTITLE,COST
9      COST(2)=TINCOM
10     RETURN
11     70  READ(8*IC6,ERR=600) ISD,DCODE,DTITLE,COST
12     COST(2)=TINCOM
13     RETURN
14     10  COST(1)=COST(1)+TACO
15     RETURN
16     25  COST(3)=TINCOM
17     20  COST(1)=TACO
18     COST(2)=PTAX
19     RETURN
20     30  COST(4)=TINCOM
21     COST(3)=COST(2)
22     COST(2)=COST(1)
23     COST(1)=TACO
24     RETURN
25     40  COST(1)=COST(1)+TACO
26     RETURN
27     65  COST(2)=TINCOM
28     RETURN
29     45  READ(8*IS14,ERR=600) ISD,DCODE,DTITLE,COST
30     RETURN
31     75  READ(8*113,ERR=600) ISD,DCODE,DTITLE,COST
32     RETURN
33     50  COST(4)=TINCOM
34     COST(3)=COST(2)
35     COST(2)=COST(1)
36     COST(1)=TACO*(1.-DWNPT)
37     RETURN
38     60  READ(8*IC7,ERR=600) ISD,DCODE,DTITLE,COST
39     COST(3)=TINCOM
40     ACOST(1)=COST(1)*(1.-PCT(IP)/100.)
41     ACOST(2)=COST(2)
42     ACOST(3)=COST(3)
43     READ(8*17,ERR=600) ISD,DCODE,DTITLE
44     WRITE(8*17,ERR=600) ISD,DCODE,DTITLE,ACOST
45     RETURN
46     15  ACOST(1)=COST(1)*(1.-PCT(IP)/100.)
47     ACOST(2)=COST(2)
48     READ(8*IS7,ERR=600) ISD,DCODE,DTITLE
49     WRITE(8*IS7,ERR=600) ISD,DCODE,DTITLE,ACOST
50     RETURN
51     600  PRINT *, 'ERROR IN LOAD'
52     9    RETURN
53     END

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SHCOST SOURCE LIST

APRT.S A.NETREP

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SHCOST(1).NETREP

```

1      SUBROUTINE NETREP
2      INCLUDE PARS
3      COMMON/NFLT/FLATE
4      C COMPUTES NET REPLACEMENT COSTS AND MAINTENANCE COSTS
5      C*** TESTS FOR INFLATED OR REGULAR COSTS AND USES THE APPROPRIATE ONE
6      C*** COMPUTES PRESENT VAL ACTUAL AND ANNUALIZED COSTS
7      IF(IRC1.EQ. 0) GO TO 210
8      CALL SBLNK
9      READ(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST,
10     *FLCOST
11     IF(ISUB(2).GT. 0) GO TO 85
12     CHK=0.0
13     DO 30 I=1, NYR
14     30   CHK=CHK+COST(I)
15     IF(CHK .LE. 0.0) GO TO 210
16     DO 70 I=1, NYR
17     C*** CHECK FOR INFLATION IF TRUE USE FLCOST ELSE USE COST
18     IF(FLATE.NE.0.0) ACTUAL(I)=FLCOST(I)
19     IF(FLATE.EQ.0.0) ACTUAL(I)=COST(I)
20     ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(I)
21     TOTAL(I)=ACTUAL(I)/(1.0+DISC)**I
22     70   TOTAL(NYR+1)=TOTAL(NYR+1)+TOTAL(I)
23     GO TO 205
24     C TOTAL(1<NYR) ARE COST FOR YEAR 1
25     C TOTAL(NYR+1) IS PRESENT VALUE COST
26     C TOTAL(NYR+2) IS ANNUAL COST
27     85   DO 200 II=2,K1
28     C*****
29     C*** IF HERE THERE ARE SUBLEVELS TO BE COMPUTED
30     IF(ISUB(11).LE.0) GO TO 200
31     READ(8*ISUB(11),ERR=600) ISA, ACODE, ATITLE, ACOST,
32     *AFCOST
33     DO 90 I=1, NYR
34     IF(FLATE.NE.0.0) BCTUAL(I)=AFCOST(I)
35     IF(FLATE.EQ.0.0) BCTUAL(I)=ACOST(I)
36     BCTUAL(NYR+1)=BCTUAL(NYR+1)+BCTUAL(I)
37     ATOTAL(I)=BCTUAL(I)/(1.0+DISC)**I
38     ACTUAL(I)=BCTUAL(I)+ACTUAL(I)
39     TOTAL(I)=TOTAL(I)+ATOTAL(I)
40     90   ATOTAL(NYR+1)=ATOTAL(NYR+1)+ATOTAL(I)
41     ATOTAL(NYR+2)=ATOTAL(NYR+1)+AC*ACT
42     WRITE(8*ISUB(11),ERR=600) ISA, ACODE, ATITLE, ACOST,
43     *AFCOST, ATOTAL, BCTUAL
44     ACTUAL(NYR+1)=ACTUAL(NYR+1)+BCTUAL(NYR+1)
45     TOTAL(NYR+1)=TOTAL(NYR+1)+ATOTAL(NYR+1)
46     ATOTAL(NYR+1)=0.0
47     ATOTAL(NYR+2)=0.0
48     BCTUAL(NYR+1)=0.0
49     200   CONTINUE
50     205   TOTAL(NYR+2)=TOTAL(NYR+1)+AC*FACT
51     WRITE(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST,
52     *FLCOST, TOTAL, ACTUAL
53     210   IF(IRC2.EQ. 0) GO TO 550
54     CALL SBLNK
55     C MAINTENANCE COSTS

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56      READ(8*IRC2,ERR=600) ISUB, CODE, TITLE, COST,
57      *FLCOST
58      IF (ISUB(2) .GT. 0) GO TO 330
59      DO 240 J=1, NYR
60      IF (FLATE.NE.0.0) ACTUAL(J)=FLCOST(J)
61      IF (FLATE.EQ.0.0) ACTUAL(J)=COST(J)
62      TOTAL(J)=FLCOST(J)/(1.0+DISC)**J
63      ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(J)
64      240  TOTAL(NYR+1)=TOTAL(NYR+1)+TOTAL(J)
65      TOTAL(NYR+2)=TOTAL(NYR+1)*ACFACT
66      GO TO 530
67      300  DO 350 J=2, K1
68      IF (ISUB(J) .LE. 0) GO TO 350
69      READ(8*ISUB(J),ERR=600) ISA, ACODE, ATITLE, ACOST,
70      *AFCOST
71      C*** IF HERE SUBLEVELS ARE TO BE COMPUTED
72      DO 320 J1=1, NYR
73      IF (FLATE.EQ.0) BCTUAL(J1)=COST(J1)
74      IF (FLATE.NE.0) BCTUAL(J1)=AFCOST(J1)
75      BCTUAL(NYR+1)=BCTUAL(J1)+BCTUAL(NYR+1)
76      ACTUAL(J1)=ACTUAL(J1)+BCTUAL(J1)
77      ATOTAL(J1)=BCTUAL(J1)/(1.0+DISC)**J1
78      TOTAL(J1)=TOTAL(J1)+ATOTAL(J1)
79      320  ATOTAL(NYR+1)=ATOTAL(NYR+1)+ATOTAL(J1)
80      ATOTAL(NYR+2)=ATOTAL(NYR+1)*ACFACT
81      TOTAL(NYR+1)=TOTAL(NYR+1)+ATOTAL(NYR+1)
82      ACTUAL(NYR+1)=ACTUAL(NYR+1)+BCTUAL(NYR+1)
83      WRITE(8*ISUB(J),ERR=600) ISA, ACODE, ATITLE, ACOST,
84      *AFCOST, ATOTAL, BCTUAL
85      ATOTAL(NYR+1)=0.0
86      ATOTAL(NYR+2)=0.0
87      BCTUAL(NYR+1)=0.0
88      350  CONTINUE
89      TOTAL(NYR+2)=TOTAL(NYR+1)*ACFACT
90      500  WRITE(8*IRC2,ERR=600) ISUB, CODE, TITLE, COST,
91      *FLCOST, TOTAL, ACTUAL
92      550  RETURN
93      600  WRITE(6,601)
94      601  FORMAT(5X, 'ERROR IN NETREP')
95      RETURN
96      END

```

APRT,S A.NFLATE

SHCOST(1),NFLATE

```

1      SUBROUTINE NFLATE
2      INCLUDE PARS
3      COMMON /NFLT/ FLATE
4      I
5      CONTINUE
6      CHK=0
7      I=2
8      C*****
9      C*** READ TOP LEVEL IF NO COSTS ARE HERE SEARCH LOWER LEVELS
10     C*****
11     READ(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST
12     1001 FORMAT(1X, 3X, 'ISUBS>>>', 20(1X, I4))
13     FLAT=FLATE+1.0
14     IF(COST(1) .EQ. 0) GO TO 50
15     DO 43 I=1, NYR
16     II=I+JYDSC
17     40 FLCONST(I)=COST(I)*FLAT**II
18     WRITE(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST,
19     *FLCONST
20     GO TO 520
21     C*****
22     C*** DETERMINE TYPE OF DATA AND DECIDE IF INFLATION APPLIES
23     C*****
24     50 ISWTCH=ISUB(I)-IRC1
25     IF((ISWTCH .GT. 16 .OR. ISWTCH .LE. 0) GO TO 300
26     READ(8*ISUB(I),ERR=600) ISA, CODE, TITLE, COST
27     IF(ISUB(I) .GT. 100) GO TO 100
28     GO TO (350, 350, 350, 55, 250, 350, 250, 250, 350, 250, 350, 350, 350, 350,
29     *250, 350, 350), ISWTCH
30     100 GO TO (350, 350, 350, 55, 250, 350, 250, 250, 350, 350, 350, 350, 350,
31     *250, 350, 350), ISWTCH
32     C*****
33     C*** CHECK COSTS IN LEVELS UNTIL NOT = ZERO
34     C*** WHEN NOT 0 INFLATE COSTS AND PUT IN FLCONST
35     C*****
36     55 DO 69 J=1, NYR
37     60 CHK=CHK+COST(J)
38     IF (CHK .NE. 0.0) GO TO 270
39     II=2
40     IF((ISA(II) .LE. 0) GO TO 165
41     READ(8*ISA(II),ERR=600) ISB, CODE, TITLE, COST
42     DO 70 J=1, NYR,
43     70 CHK=CHK+COST(J)
44     IF (CHK .NE. 0.0) GO TO 150
45     I2=2
46     IF((ISB(I2) .LE. 0) GO TO 110
47     READ(8*ISB(I2),ERR=600) ISC, CODE, TITLE, COST
48     DO 80 J=1, NYR
49     80 CHK=CHK+COST(J)
50     IF (CHK .LE. 0.0) GO TO 300
51     DO 90 J=1, NYR
52     90 JJ=J+JYDSC
53     FLCONST(J)=COST(J)*FLAT**JJ
54     WRITE(8*ISB(I2),ERR=600) ISC, CODE, TITLE, COST,
55     *FLCONST
56     I2=I2+1

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56      CHK=0.0
57      IF (I2 .LE. K1) GO TO 75
58      GO TO 165
59      DO 160 J=1,NYR
60      JJ=J+JYDSC
61      160  FLCOST(J)=COST(J)+FLAT**JJ
62      WRITE(8*ISA(I1),ERR=600) ISB, CODE, TITLE, COST,
63      +FLCOST
64      165  I1=I1+1
65      CHK=0.0
66      IF(I1 .LE. K1) GO TO 65
67      GO TO 240
68      200  DO 210 J=1,NYR
69      JJ=J+JYDSC
70      210  FLCOST(J)=COST(J)+FLAT**JJ
71      WRITE(8*ISUB(I),ERR=600) ISA, CODE, TITLE, COST,
72      +FLCOST
73      240  I=I+1
74      CHK=0.0
75      IF(I .LE. K1) GO TO 50
76      GO TO 520
77      C*****
78      C*** COSTS HERE ARE IN FORM OF ONE COST BUT NEED TO BE INFLATED
79      C*** COST (1) IS INFLATED BY YEAR
80      C*****
81      250  IF (COST(1) .EQ. 0.0 .AND. ISA(1) .NE. 0) GO TO 270
82      DO 255 J=1,NYR
83      JJ=J+JYDSC
84      255  FLCOST(J)=COST(1)+FLAT**JJ
85      WRITE(8*ISUB(1),ERR=600) ISA, CODE, TITLE, COST,
86      +FLCOST
87      GO TO 300
88      270  I1=2
89      275  IF (ISA(I1) .LE. 0) GO TO 290
90      READ(8*ISA(I1),ERR=600) ISB, CODE, TITLE, COST
91      IF (COST(1) .EQ. 0) GO TO 300
92      DO 280 J=1,NYR
93      JJ=J+JYDSC
94      280  FLCOST(J)=COST(1)+FLAT**JJ
95      WRITE(8*ISA(I1),ERR=600) ISB, CODE, TITLE, COST,
96      +FLCOST
97      290  I1=I1+1
98      IF(I1 .LE. K1) GO TO 275
99      300  I=I+1
100      CHK=0.0
101      IF(I .LE. K1) GO TO 50
102      GO TO 520
103      350  DO 370 JJ=1,NYR
104      C*****
105      C*** THESE COSTS ARE NOT INFLATED BUT COSTS ARE PLACED IN FLCOST
106      C*****
107      IF (ISWTCN .NE. 6) FLCOST(JJ)=COST(JJ)
108      FLCOST(JJ)=COST(1)
109      370  CONTINUE
110      WRITE(8*ISUB(I),ERR=600) ISA, CODE, TITLE, COST,
111      +FLCOST

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117      GO TO 300
113      RETURN
114      600  WRITE(6,601)
115      601  FORMAT(5X,'ERROR IN N=LATE')
116      RETURN
117      C      DEBUG TRACE,SUBTRACE,INIT
118      C      AT 1
119      C      TRACE ON
120      END
    
```

DPRT,S A,PAGES

## SHCOST(1).PAGES

```

1      SUBROUTINE PAGES(NUML)
2      COMMON/PAGE/N1,IPAGNO,LCN,LNCNT,TITLE
3      COMMON/SEC/ISECT
4      COMMON/CITYS/NAMES(151)
5      CHARACTER NAMES*63,N1*6,TITLE*30,NAME*63
6      CHARACTER*27 FORMTS(9),FORMAT
7      CHARACTER*4 MONTHS(12)
8      DATA NAME/63H
9
10     1
11     DATA MONTHS/'JAN.','FEB.','MAR.','APR.','MAY ','JUNE','JULY',
12     1      'AUG.','SEP.','OCT.','NOV.','DEC'/
13     DATA FORMTS/'(1H+.T120.I3.1H..I1.1H..I1)',
14     1      '(1H+.T120.I3.1H..I1.1H..I2)',
15     1      '(1H+.T120.I3.1H..I1.1H..I3)',
16     1      '(1H+.T120.I3.1H..I2.1H..I1)',
17     1      '(1H+.T120.I3.1H..I2.1H..I3)',
18     1      '(1H+.T120.I3.1H..I3.1H..I1)',
19     1      '(1H+.T120.I3.1H..I3.1H..I2)',
20     1      '(1H+.T120.I3.1H..I3.1H..I3)'/
21     LNCNT=LNCNT+NUML
22     IF(LNCNT.LE.53) RETURN
23     IPAGNO=IPAGNO+1
24     LNCNT=NUML
25     IF(LNCNT.GT.55) LNCNT=4
26     DECODE(6,101,N1) IM,ID,IY
27     101  FORMAT(3I2)
28         IF(LCN.NE.0) NAME=NAMES(LCN)
29     WRITE(6,102) TITLE,NAME,MONTHS(IM),ID,IY
30     NUM=0
31     IF(ISECT.GE.10) NUM=NUM+3
32     IF(ISECT.GE.100) NUM=NUM+3
33     IF(IPAGNO.GE.10) NUM=NUM+1
34     IF(IPAGNO.GE.100) NUM=NUM+1
35     NUM=NUM+1
36     FORMAT=FORMTS(NUM)
37     WRITE(6,FORMAT) LCN,ISECT,IPAGNO
38     100  FORMAT(1H1,A30,A63,1X,A4,I3,' ',19',I2)
39     WRITE(6,102)
40     102  FORMAT(//)
41     RETURN
42     END

```

99



## SHCOST(1).PARS

```

1  PAMS PROC
2  C  PARAMETERS FOR SOLAR COST PROGRAM
3  C      PARAMETERS IS1 & IC1 MUST BE UPDATED IF THE BLOCK # OF
4  C      SHVAC AND/OR CHVAC ARE CHANGED. OTHER BLOCKS UNDER
5  C      THESE BLOCKS NEED NOT BE CHANGED AS LONG AS THEY CORRESPOND
6  C      TO THE BLOCK # INDICATED IN THIS PROC. FAILURE TO ADJUST THESE
7  C      PARAMETERS TO THE APPROPRIATE VALUES WILL YIELD UNPREDICTABLE
8  C      RESULTS. THESE PARAMETERS ARE USED TO KEY ON THESE BLOCKS
9  C      FOR THE SPECIFIC CALCULATIONS USED FOR THAT ITEM.
10 C
11 C      PARAMETER IL= 100      @BLOCK # OF LIFE CYCLE COSTS
12 C      SOLAR PARAMETERS ISX
13 C      PARAMETER IS1=1      @ BLOCK # OF SHAC
14 C      PARAMETER IS2=IS1+1      @ BLOCK OF ACQUISITIONS
15 C      PARAMETER IS3=IS1+2      @ BLOCK # OF BUILDING MODIFICATIONS
16 C      PARAMETER IS4=IS1+3      @ BLOCK # OF SPACE OCCUPIED
17 C      PARAMETER IS5=IS1+4      @ BLOCK # OF NET REPAIRS
18 C      PARAMETER IS6=IS1+5      @ BLOCK # OF MAINTENANCE
19 C      PARAMETER IS7=IS1+6      @ BLOCK # OF OPERATIONS
20 C      PARAMETER IS8=IS1+7      @ BLOCK # OF PROPERTY TAX
21 C      PARAMETER IS9=IS1+8      @ BLOCK # OF PROPERTY TAX DEDUCTIONS
22 C      PARAMETER IS10=IS1+9      @ BLOCK # OF DEPRECIATION DEDUCTIONS
23 C      PARAMETER IS11=IS1+10      @ BLOCK # OF ADDED INCOME
24 C      PARAMETER IS12=IS1+11      @ BLOCK # OF INSURANCE COSTS
25 C      PARAMETER IS13=IS1+12      @ BLOCK # OF SALVAGE VALUE AFTER N YEARS
26 C      PARAMETER IS14=IS1+13      @ BLOCK # OF LOAN MORTGAGE
27 C      PARAMETER IS15=IS1+14      @ BLOCK # OF LOAN PAY
28 C      PARAMETER IS16=IS1+15      @ BLOCK # OF MAINTENANCE DEDUCT FROM INC TAX
29 C      PARAMETER IS17=IS1+16      @ BLOCK # OF ENERGY DEDUCTS FOR COMMERCIAL
30 C  CONVENTIONAL PARAMETERS ICX
31 C      PARAMETER IC1=101      @ BLOCK # OF CHVAC
32 C      PARAMETER IC2=IC1+1      @ BLOCK # OF ACQUISITIONS
33 C      PARAMETER IC3=IC1+2      @ BLOCK # OF BUILDING MODIFICATIONS
34 C      PARAMETER IC4=IC1+3      @ BLOCK # OF SPACE OCCUPIED
35 C      PARAMETER IC5=IC1+4      @ BLOCK # OF NET REPAIRS
36 C      PARAMETER IC6=IC1+5      @ BLOCK # OF MAINTENANCE
37 C      PARAMETER IC7=IC1+6      @ BLOCK # OF OPERATIONS
38 C      PARAMETER IC8=IC1+7      @ BLOCK # OF PROPERTY TAX
39 C      PARAMETER IC9=IC1+8      @ BLOCK # OF PROPERTY TAX DEDUCTIONS
40 C      PARAMETER IC10=IC1+9      @ BLOCK # OF DEPRECIATION DEDUCTIONS
41 C      PARAMETER IC12=IC1+12      @ BLOCK # OF SALVAGE
42 C      PARAMETER IC11=IC1+11      @ BLOCK # OF INSURANCE
43 C      PARAMETER IC13=IC1+13      @ BLOCK # OF MORTGAGE
44 C      PARAMETER IC14=IC1+14      @ BLOCK # OF LOAN PAY
45 C      PARAMETER IC15=IC1+15
46 C      PARAMETER IC16=IC1+16
47 C      PARAMETER IY=24      @ ARRAY SIZE OF YEAR ARRAY
48 C      PARAMETER NCST=IY+8      @ ARRAY SIZE OF COSTS ARRAYS
49 C      PARAMETER NTOT=NCST      @ ARRAYSIZE OF TOTAL
50 C      PARAMETER K1=17      @ ARRAY SIZE IF ISUB
51 C      PARAMETER IP1=2      @ ARRAYSIZE OF CODE
52 C      PARAMETER IP2=6      @ ARRAY SIZE OF TITLE
53 C      PARAMETER K2=2*NCST+2*NTOT+K1+IP1+IP2+8
54 C      PARAMETER K3=K2+2+25      @ BUFFER ARRAY SIZE
55 C      PARAMETER L1=2      @ # OF LEVEL 1 GROUPS

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56      PARAMETER L2=0          0 # OF LEVEL 2 GROUPS
57      PARAMETER L3=3          0 # OF LEVEL 3 GROUPS
58      PARAMETER L4=0          0 # OF LEVEL 4 GROUPS
59      PARAMETER L5=0          0 # OF LEVEL 5 GROUPS
60      PARAMETER L6=10         0 # OF LEVEL 6 GROUPS
61      PARAMETER NR=L1+L2+L3+L4+L5+L6
62      PARAMETER IGFL=75
63      PARAMETER NTR=NR*4
64      INTEGER DATOPT,CLTPRM
65      CHARACTER*5 CODE,CCODE,ECODE,ACODE,BCODE,DCODE
66      CHARACTER*9 TITLE(6),ATITLE(6),BTITLE(6),CTITLE(6),DTITLE(6)
67      *,ETITLE(6)
68      COMMON/SHAC2/ISUB(K1),CODE,TITLE,COST(MCST),TOTAL(MTOT),
69      *FLCOST(MCST),AFCOST(MCST),BFCOST(MCST),CFCOST(MCST),DFCOST(MCST),
70      *ACTUAL(MTOT),BCTUAL(MTOT),CCTUAL(MTOT),DCTUAL(MTOT)
71      COMMON/SHAC1/NYR,IYR(IY),DISC,ACFACT,ICON,IRC1,IRC2,IRC3,IRC4,
72      *NBLK,BUFFER(K3),IYRST,I,IJK,IRCS,IDSC,INRGY,ILFCY,JYDSC,IDISC,
73      *DUMPHY,CSTPSH,CLTPRM,LCN,LOA,XLOAD,IPLOTS,TINCON,PTAX
74      COMMON/SHAC3/ ACOST(MCST),BCOST(MCST),CCOST(MCST),DCOST(MCST),
75      *ATITLE,BTITLE,CTITLE,DTITLE,ACODE,DATOPT,BCODE,
76      *CCODE,DCODE,ISA(K1),ISB(K1),ISC(K1),ISD(K1),ATOTAL(MTOT),
77      *BTOTAL(MTOT),CTOTAL(MTOT)
78      COMMON/3=LD/AREA(IGFL),PCT(IGFL),G(IGFL),PRICE(IGFL)
79      COMMON/DSFOP/DSSTRT,DSSTOP,DSSTEP,FTSTRT,FTSTOP,FTSTEP,
80      *OPSTRT,OPSTOP,OPSTEP,IPLTOP,PTSTRT,PTSTOP,PTSTEP,TSTRT,TSTOP,
81      *,TSTEP
82      DIMENSION ISC(K1),ETOTAL(MCST),ECOST(MCST)
83      END

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SPRT,S A,PLTDV



SHCOST(1).PLTDRV

```

1      SUBROUTINE PLTDRV(X,Y,XCNT,IPLTOP,IPLOTS)
2      INTEGER XCNT
3      CHARACTER*55 LABEL(6),LAB(5)
4      DIMENSION X(25),Y(25,5),Z(25),K(5)
5
6      C      PRINT *, 'ONE'
7      50    K(1)=0
8           DO 14 J=2,5
9           YMAX=Y(1,J)
10          DO 13 I=2,XCNT
11          IF(Y(I,J).GT.YMAX) YMAX=Y(I,J)
12          IF(YMAX.LT.100.0) GO TO 12
13          K(J)=K(J)+1
14          YMAX=YMAX/10.0
15          GO TO 11
16          12    DO 14 I=1,XCNT
17          14    Y(I,J)=Y(I,J)/(10**K(J))
18          LABEL(4)=50MPRESENT VALUE COST
19          LABEL(2)=50MACTUAL COST
20          IMIN=X(1)
21          XMAX=FLOAT(IMIN)
22          XMIN=XMAX
23          IF(X(XCNT)-XMAX*.8) 19,16,17
24          19    XMAX=XMAX*.8
25          IF(XMAX.LT.X(XCNT)) GO TO 19
26          GO TO 16
27          16    XMAX=X(XCNT)
28          GO TO 18
29          17    XMAX=XMAX*.8
30          IF(XMAX.LT.X(XCNT)) GO TO 17
31          18    YMIN=0.
32          YMAX=99.
33          GO TO (1,2,3,4,5,6),IPLTOP
34          1      LABEL(1)=50MCOLLECTOR AREA
35          LABEL(2)=50MPERCENT LOAD - ACTUAL COST
36          LABEL(3)=50MPERFORMANCE AND COST AS RELATED TO COLLECTOR AREA
37          LABEL(5)=50MPRESENT VALUE COST AS RELATED TO COLLECTOR AREA
38          C      XMAX=160.0
39          C      XMIN=0.
40          YMIN=17.
41          YMAX=100.
42          GO TO 9
43          2      LABEL(1)=50MDISCOUNT RATE
44          LABEL(3)=50MACTUAL COST AS RELATED TO DISCOUNT RATE
45          LABEL(5)=50MPRESENT VALUE COST AS RELATED TO DISCOUNT RATE
46          GO TO 9
47          3      LABEL(1)=50MINFLATION RATE
48          LABEL(3)=50MACTUAL COST AS RELATED TO INFLATION RATE
49          LABEL(5)=50MPRESENT VALUE COST AS RELATED TO INFLATION RATE
50          GO TO 9
51          4      LABEL(1)=50MDOWNPAYMENT PERCENT
52          LABEL(5)=50MPRESENT VALUE COST AS RELATED TO DOWNPAYMENT
53          LABEL(3)=50MACTUAL COST AS RELATED TO DOWNPAYMENT
54          GO TO 9
55          5      LABEL(1)=50MPROPERTY TAX RATE

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56 LABEL(3)=50MACTUAL COST AS RELATED TO PROPERTY TAX RATE
57 LABEL(5)=50MPRESENT VALUE COST AS RELATED TO PROPERTY TAX RATE
58 GO TO 9
59 6 LABEL(1)=50MINCOME TAX RATE
60 LABEL(3)=50MACTUAL COST AS RELATED TO INCOME TAX RATE
61 LABEL(5)=50MPRESENT VALUE COST AS RELATED TO INCOME TAX RATE
62 9 CONTINUE
63 IF(IPLTOP.EQ.2) GO TO 30
64 DO 21 I=1,3
65 DO 20 I=1,XCNT
66 20 Z(I)=Y(I,J)
67 ICODE=J
68 IF(IPLTOP.NE.1.AND.J.EQ.1) GO TO 21
69 IF(IPLTOP.NE.1.AND.J.EQ.2) ICODE=1
70 CALL PLOTTER (X,Z,XCNT,LABEL(1),LABEL(2),LABEL(3),XMIN,XMAX,YMIN,
71 SYMAX,ICODE)
72 21 CONTINUE
73 LAB(1)=50MPRECENT LOAD COVERED
74 LAB(2)=50MACTUAL COST OF THE SHVAC
75 LAB(3)=50MACTUAL COST OF THE CHVAC
76 LAB(4)=50MPRESENT VALUE COST OF THE SHVAC
77 LAB(5)=50MPRESENT VALUE COST OF THE CHVAC
78 ICODE=1
79 IF(IPLTOP.NE.1) GO TO 51
80 CALL LEGEND(LAB(1),K(1),1)
81 ICODE=2
82 51 CALL LEGEND(LAB(2),K(2),ICODE)
83 CALL LEGEND(LAB(3),K(3),3)
84 30 DO 53 J=4,5
85 DO 50 I=1,XCNT
86 50 Z(I)=Y(I,J)
87 ICODE=1
88 IF(J.EQ.5) ICODE=3
89 53 CALL PLOTTER (X,Z,XCNT,LABEL(1),LABEL(4),LABEL(5),XMIN,XMAX,YMIN,
90 SYMAX,ICODE)
91 CALL LEGEND(LAB(4),K(4),1)
92 CALL LEGEND(LAB(5),K(5),3)
93 DO 15 I=1,XCNT
94 DO 15 J=1,5
95 15 Y(I,J)=Z
96 XCNT=0
97 RETURN
98 END

```

SHCOST(1).PLOTS

```

1      SUBROUTINE PLOTTER(A,B,NR,XTLE,YTLE,HEADER,XMIN,XMAX,YMIN,YMAX,IO)
2      DIMENSION X(25),Y(25),A(25),B(25)
3      CHARACTER*4 XTLE(16),YTLE(16),HEADER(16),LOCN(16)
4      IXCHR=0
5      IYCHR=0
6      DO 10 I=1,16
7      IF(XTLE(I).EQ.4H) ) GO TO 11
8      IXCHR=IXCHR+4
9      DO 12 I=1,16
10     IF(YTLE(I).EQ.4H) ) GO TO 13
11     IYCHR=IYCHR+4
12     DO 14 I=1,16
13     IF(HEADER(I).EQ.4H) ) GO TO 15
14     IHCHR=IHCHR+4
15     CONTINUE
16     IFLG=0
17     DO 16 II=1,NR
18     X(II)=A(II)
19     Y(II)=B(II)
20     IF(II.EQ.1) GO TO 25
21     XNUM=0
22     CALL SYMBOL(0.0,1.0,2.0,143,HEADER,0.0,IHCHR)
23     SCA=(XMAX-XMIN)/8.0
24     CALL AXIS(0.0,1.0,XTLE,-IXCHR,0.0,0.0,XMIN,SCA)
25     SCA=(YMAX-YMIN)/9.0
26     CALL AXIS(0.0,1.0,YTLE,IYCHR,0.0,0.0,YMIN,SCA)
27     DO 23 I=0,8
28     XB=FLOAT(I)
29     CALL PLOT(XB,1.0,3)
30     CALL PLOT(XB,10.0,2)
31     IF(I.EQ.8) GO TO 23
32     CALL PLOT(XB+0.5,10.0,3)
33     CALL PLOT(XB+0.5,1.0,2)
34     CONTINUE
35     DO 24 I=1,10
36     XB=FLOAT(I)
37     CALL PLOT(0.0,XB,3)
38     CALL PLOT(8.0,XB,2)
39     IF(I.EQ.10) GO TO 24
40     CALL PLOT(8.0,XB+0.5,3)
41     CALL PLOT(0.0,XB+0.5,2)
42     CONTINUE
43     CALL SCALE(X,XMIN,XMAX,0.0,8.0,NR)
44     CALL SCALE(Y,YMIN,YMAX,1.0,9.0,NR)
45     CALL PLOT(X(1),Y(1),3)
46     DO 33 K1=2,NR
47     IF(X(K1).LT.0.0) X(K1)=0.0
48     IF(X(K1).GT.9.0) X(K1)=9.0
49     IF(Y(K1).LT.0.0) Y(K1)=0.0
50     IF(Y(K1).GT.10.0) Y(K1)=10.0
51     CALL PLOT(X(K1),Y(K1),2)
52     CONTINUE
53     XNUM=XNUM+1
54     DO 32 K1=1,NR
55

```

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36 32 CALL NUMBER(X(K1),Y(K1),.371,XNUM,).0,-3)  
37 IF(10.E0.3) CALL PLOT(12.0,0.0,-3)  
38 RETURN  
39 END

APRT.S A.POSAVL

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SHCOST(1).POSAVE

```

1 SUBROUTINE POSAVE
2 INCLUDE PARS
3 COMMON/SEC/ISECT
4 COMMON/IPL/IP
5 COMMON/NFLT/FLATE
6 COMMON/CYLIF/CYLF(6)
7 COMMON/SUM/SHVAC,CHVAC,ACLC,PCVLC,ACLCFC,PCVLCFC,PSHAC,PCMAC
8 DIMENSION CUMSAV(17),ACUMSV(17)
9 READ(8,'IS1,ERR=600') ISE,ECODE,ETITLE,ECOST,ETOTAL,TOTAL,
10 *ACTUAL
11 READ(8,'IC1,ERR=600') ISE,ECODE,ETITLE,ECOST,ETOTAL,ATOTAL,
12 *ACTUAL
13 IF LG=1
14 IA=LG=1
15 DO 100 I=1,NYR
16 II=I-1
17 APOSAV=BCTUAL(II)-ACTUAL(II)
18 IF(I.NE.1)ACUMSV(II)=ACUMSV(II)+APOSAV
19 IF(I.EQ.1)ACUMSV(II)=APOSAV
20 PSAVE=ATOTAL(II)-TOTAL(II)
21 IF(I.NE.1)CUMSAV(II)=CUMSAV(II)+PSAVE
22 IF(I.EQ.1)CUMSAV(II)=PSAVE
23 IF(APOSAV.LE. 0.0R. IA*LG.NE. 1) GO TO 70
24 IA=LG=99
25 IASVYR=I+IYRST
26 70 IF(PSAVE.LE. 0.0R. I*LG.NE. 1) GO TO 100
27 I*LG=99
28 ISVYR=I+IYRST
29 100 CONTINUE
30 ISV=ISVYR-IYRST
31 IASV=IASVYR-IYRST
32 FSAVE=ATOTAL(ISV)-TOTAL(ISV)
33 APOSAV=BCTUAL(IASV)-ACTUAL(IASV)
34 CALL PAGES(NYR+1)
35 WRITE(6,200) ISVYR,PSAVE,IASVYR,APOSAV,(IYR(K),CUMSAV(K),
36 *ACUMSV(K),K=1,NYR)
37 FLATE1=FLATE+100.0
38 TINCH1=TINCH+100.0
39 PTAX1=PTAX+100.0
40 DISC1=DISC+100.0
41 DNPMT=DNPMT+100.0
42 IF(IPLTOP.EQ.1) VARY=AREA(IP)
43 IF(IPLTOP.EQ.2) VARY=DISC+100.0
44 IF(IPLTOP.EQ.3) VARY=FLATE+100.0
45 IF(IPLTOP.EQ.4) VARY=DNPMT+100.0
46 IF(IPLTOP.EQ.5) VARY=PTAX+100.0
47 IF(IPLTOP.EQ.6) VARY=TINCH+100.0
48 WRITE(9,'ISECT,ERR=600') ISECT,VARY,PCT(IP),3(IP)
49 *FLATE1,DISC1,DNPMT,CSTPSH,TINCH1,PTAX1,AREA(IP),SHVAC,CHVAC,CYLF
50 *PSHAC,PCMAC
51 200 FORMAT(1X,132(' '),/2X,'IN YEAR ',15,1X,'POSITIVE SAVINGS WILL ',
52 *OCCUR BY',/2X,'AN AMOUNT OF ',F10.2,' IN TERMS OF PRESENT VALUE',
53 *DOLLARS',/2X,'IN YEAR ',15,1X,'POSITIVE SAVINGS WILL OCCUR',
54 *BY',/2X,'AN AMOUNT OF ',F10.2,' IN TERMS OF ACTUAL DOLLARS',/
55 *BY',/2X,'AN AMOUNT OF ',F10.2,' IN TERMS OF ACTUAL DOLLARS',/

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56      * VALUE SAVINGS*,2X,'ACTUAL SAVINGS',/,
57      *QJ('-'*),/,5D(1X,15.8X,F10.2,12X,F10.2,/)
58      RETURN
59      600      WRITE(6,691)
60      601      FORMAT(5X,'ERROR IN POSAVE')
61      RETURN
62      END

```

APRT,S A.PVAC

SHCOST(1),PVAC

```

1      SUBROUTINE PVAC
2      INCLUDE PARS
3      DIMENSION IBTRM(13)
4      DATA IBTRM/9,10,13,14,11,16,17,109,110,112,113,115,116/
5      C  COMBINES TOTALS IN MAJOR AREAS TO OBTAIN PV AND AC
6      IF(IRC1.EQ.0) GO TO 150
7      CALL SBLNK
8      READ(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST,
9      *FLCOST
10     KK=K1+10*MCST*2
11     AC=0.0
12     PV=0.0
13     ACT=0.0
14     NYRR=NYR*4
15     DO 100 I=2,K1
16     SIGN=1.0
17     IF(ISUB(I).LE.0) GOTO 130
18     C  READ SUBLEVELS FOR PREVIOUSLY COMPUTED PV AND AC COSTS
19     READ(8*ISUB(I),ERR=600) ISA,BCODE,BTITLE,BCOST,
20     *BFCOST,TOTAL,ACTUAL
21     C  DETERMINE SIGN FOR CALCULATION
22     C*** PROPERTY TAX DEDUCTIONS, DEPRECIATION DEDUCTIONS, SALVAGE
23     C*** VALUE AFTER N YEARS, INTEREST ON MORTGAGE AND
24     C*** AFTER TAX INCOME ARE SUBTRACTED FROM THE TOTAL COSTS
25     C*** ALL OTHER COSTS ARE ADDED TO THE TOTAL COSTS.
26     DO 10 11 = 1,13
27     10  IF(ISUB(I).EQ.IBTRM(11)) SIGN=-1.0
28     IF(ISUB(I).GT. IRC1*3 )GO TO 35
29     ATOTAL(1)=TOTAL(NYR*3)*SIGN+ATOTAL(1)
30     BCTUAL(1)=TOTAL(NYR*3)*SIGN+BCTUAL(1)
31     ACT=ACT+TOTAL(NYR*3)*SIGN
32     PV=PV+TOTAL(NYR*3)*SIGN
33     AC=AC+TOTAL(NYR*2)*SIGN
34     GO TO 100
35     IF(ISUB(I).NE.13.AND.ISUB(I).NE.112) GO TO 37
36     ACT=ACT-ACTUAL(NYR*1)
37     PV=PV-TOTAL(NYR*1)
38     AC=AC-TOTAL(NYR*2)
39     BCTUAL(NYR)=BCTUAL(NYR)-ACTUAL(NYR*1)
40     ATOTAL(NYR)=ATOTAL(NYR)-TOTAL(NYR*1)
41     GO TO 130
42     37  DO 40 J=1,NYR
43     ATOTAL(J)=TOTAL(J)*SIGN+ATOTAL(J)
44     BCTUAL(J)=ACTUAL(J)*SIGN+BCTUAL(J)
45     40  CONTINUE
46     70  ACT=ACT+ACTUAL(NYR*1)*SIGN
47     PV=PV+TOTAL(NYR*1)*SIGN
48     AC=AC+TOTAL(NYR*2)*SIGN
49     100  CONTINUE
50     IF(INRGY.NE.1) GO TO 140
51     ACT=COST(3)+ACT
52     AC=AC+COST(2)
53     PV=PV+COST(1)
54     C  WRITE TOTAL PV AND AC INTO TOP LEVEL
55     140  WRITE(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST,

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56      *FLCOST,ATOTAL,9CTUAL,PV,AC,ACT
57      RETURN
58      150  WRITE(6,601)
59      600  FORMAT(5X,'ERROR IN PVAC')
60      RETURN
61      END
    
```

APRT,S A.RESULT



## SHCOST(1).RESULT

```

1      SUBROUTINE RESULT
2      INTEGER XCNT
3      COMMON/XC/XCNT
4      COMMON/=LAG/IFLG
5      COMMON/NFL7/FLATE
6      COMMON/IP1/IP
7      COMMON/SUM/SHVAC,CHVAC,ACLC5,PVLC5,ACLCFC,PVLCFC,PSHAC,PCMAC
8      COMMON/SEC/ISECT
9      COMMON/LAST/PRICEL
10     INCLUDE PARS
11     COMMON/CYLIF/CYLF(6)
12     COMMON/LNCN/NUM
13     DIMENSION X(25),Y(25,5)
14     DIMENSION NOUT(17)
15     DATA NOUT/3,3,4,4,7,9,9,7,9,7,6,6,6,9,9,9,9/
16     IRC1=IS1
17     IF(IRC1.EQ.0) GO TO 250
18     C PRINTS OUT RESULTS
19     100 CALL SBLNK
20     READ(8*IRC1,ERR=607) ISUB,CODE,TITLE
21     CALL PAGES(99)
22     CALL PAGES(3)
23     WRITE(6,10) CODE,TITLE
24     DO 200 I=2,K1
25     C*** READ SUBLEVELS OF TOP LEVEL
26     IF((ISUB(I).LE.0) GO TO 200
27     KL=ISUB(I)
28     IF(KL.GT.110) KL=KL+1
29     IF(KL.GT.100) KL=KL-100
30     NUM=NOUT(KL)+6
31     IF(KL.GE.5.AND.KL.LE.10.OR.KL.GT.13) NUM=NUM+NYR
32     CALL PAGES(NUM)
33     READ(8*ISUB(I),ERR=600) ISA,CODE,TITLE,ECOST,ETOTAL,
34     +TOTAL,ACTUAL
35     C WRITE INTERMEDIATE RESULTS
36     CALL RPRNT
37     200 CONTINUE
38     READ(8*IRC1,ERR=600) ISE,CODE,TITLE,ECOST,ETOTAL,
39     +TOTAL,ACTUAL,PV,AC,ACT
40     C WRITE FINAL RESULTS
41     CALL PAGES(NYR+8)
42     WRITE(6,15) CODE,TITLE,PV,AC,ACT
43     WRITE(6,18) (IYR(J),TOTAL(J),ACTUAL(J),J=1,NYR)
44     CHVAC=ACT
45     PCMAC=PV
46     250 IF(IRC1.EQ.ICI)GO TO 300
47     C*** CHANGE FROM SOLAR TO CONVENTIONAL
48     IRC1=ICI
49     SHVAC=ACT
50     PSHAC=PV
51     GO TO 100
52     C*** WRITE LIFE CYCLE COSTS SAVINGS IF REQUESTED
53     300 IF(ILFCY.NE.1) GO TO 400
54     READ(8*ILF,ERR=600) ISA,CODE,TITLE,CYL=
55     CALL PAGES(2)

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SHCOST(1).RFPRT

```

1      SUBROUTINE RFPRT
2      INCLUDE PARS
3      COMMON/LNCN/NUM
4      IF(IISUB(1).EQ.0) GO TO 200
5      C    SUBLEVEL HEADING
6      CONTINUE
7      WRITE(6,5) CODE,TITLE,NYR
8      5  FORMAT(1X,///,4X,A5,2X,6A4,/,2X,'COSTS OVER THE ',I3,' YEARS OF'
9      +,' THE ANALYSIS')
10     ISWICH=IISUB(1)-1
11     IF(ISWICH.GT. 100) GO TO 1
12     GO TO(1000,10,10,50,50,50,40,40,40,10,10,10,40,40,40,40),ISWICH
13     1    GO TO(1000,10,10,50,50,50,40,40,40,10,10,40,40,40,40),ISWICH-100
14     C    WRITE COST RESULTS
15     10   CONTINUE
16     WRITE(6,16) TOTAL(NYR+1),TOTAL(NYR+2),ACTUAL(NYR+1)
17     17   FORMAT(1X,/,1X,'THE DOWN PAYMENT =',1X,F10.2,/,1X,F5.2,'% OF ',
18     +,'THE TOTAL COST')
19     IF(ISA(2).GT. 0) GO TO 12
20     GO TO 200
21     12   CALL PAGES(NUM+4)
22     WRITE(6,9)
23     9    FORMAT(1X,2X,'SUBLEVEL COSTS',///)
24     DO 14 JJ=2,K1
25     IF(ISA(JJ).LE. 0) GO TO 14
26     READ(8,ISA(JJ),ERR=600) ISE,ACODE,ATITLE,ECOST,ETOTAL,
27     +BCTUAL,ATOTAL
28     WRITE(6,15) ACODE,ATITLE,ATOTAL(NYR+1),BCTUAL(NYR+1)
29     14   CONTINUE
30     15   FORMAT(1X,A5,6A4,/,1X,2X,'PRESENT VALUE = ',F12.2,/,
31     +3X,'ACTUAL COST' =',F12.2,/)
32     1000  DOWNPM=DOWNPMT*100.0
33     WRITE(6,17)TOTAL(NYR+3),DOWNPM
34     GO TO 200
35     16   FORMAT(1X,2X,'PRESENT VALUE = ',F12.2,/,3X,'ANNUAL ',
36     +,'COST' = ',F12.2,/,3X,'ACTUAL COST' =',F12.2,/)
37     C    WRITE COST RESULTS WITH YEARLY PV RESULTS
38     40   WRITE(6,45) TOTAL(NYR+1),TOTAL(NYR+2),ACTUAL(NYR+1),(IYR(J),
39     +TOTAL(J),ACTUAL(J),J=1,NYR)
40     45   FORMAT(1X,2X,'PRESENT VALUE = ',F12.2,/,3X,'ANNUAL COST' = ',
41     +F12.2,/,3X,'ACTUAL COST' = ',F12.2,/,3X,'PRESENT VALUE AND ',
42     +,'ACTUAL COSTS BY YEAR',/,4X,
43     +,'YEAR',5X,'PVCOST',5X,'ACTUAL',/,4X,'-----',5X,'-----',5X,'-----'
44     +,/,50(3X,I5,1X,=10.2,1X,=10.2,/)
45     GO TO 200
46     C*** WRITE YEARLY COSTS FOR THIS ITEM AND YEARLY COSTS FOR EACH
47     C*** OF THE COMPONENTS COMPRISING THIS ITEMS COSTS
48     50   WRITE (6,45) TOTAL(NYR+1),TOTAL(NYR+2),ACTUAL(NYR+1),(IYR(K),
49     +TOTAL(K),ACTUAL(K),K=1,NYR)
50     IF(ISA(2).LE. 0) GO TO 200
51     CALL PAGES(NUM+6)
52     WRITE(6,22) CODE,TITLE
53     DO 100 J=2,K1,3
54     J1=J+1
55     100  J2=J+2

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```

56      IF (ISA(J).EQ.0) GO TO 100
57      IF (J.NE.2) CALL PAGES(NUM)
58      READ(8*ISA(J),ERR=600) ISE, CODE, TITLE, ECOST, ETOTAL,
59      *TOTAL, ACTUAL
60      IF (ISA(J1).LE.0) GO TO 70
61      READ(8*ISA(J1),ERR=600) ISE, ACODE, ATITLE, ECOST, ETOTAL,
62      *ATOTAL, BCTUAL
63      IF (ISA(J2).LE.0) GO TO 60
64      READ(8*ISA(J2),ERR=600) ISE, BCODE, BTITLE, ECOST, ETOTAL,
65      *BTOTAL, CCTUAL
66      WRITE (6,205) CODE, (TITLE(KA),KA=1,5), ACODE, (ATITLE(KB),KB=1,5),
67      *BCODE, (BTITLE(KC),KC=1,5)
68      WRITE (6,210) TOTAL (NYR+1), ATOTAL (NYR+1), BTOTAL (NYR+1),
69      *TOTAL (NYR+2), ATOTAL (NYR+2), BTOTAL (NYR+2), ACTUAL (NYR+1),
70      *BCTUAL (NYR+1), CCTUAL (NYR+1), (IYR(K),TOTAL (K),
71      *ACTUAL (K), IYR(K), ATOTAL (K), BCTUAL (K), IYR(K), BTOTAL (K),
72      *CCTUAL (K), K=1, NYR)
73      GO TO 100
74      60 CONTINUE
75      WRITE (6,206) CODE, (TITLE(KA),KA=1,5), ACODE, (ATITLE(KB),KB=1,5)
76      WRITE (6,215) TOTAL (NYR+1), ATOTAL (NYR+1), TOTAL (NYR+2),
77      *ATOTAL (NYR+2), ACTUAL (NYR+1), BCTUAL (NYR+1), (IYR(K),TOTAL (K),
78      *ACTUAL (K), IYR(K), ATOTAL (K), BCTUAL (K), K=1, NYR)
79      GO TO 100
80      70 CONTINUE
81      WRITE (6,207) CODE, TITLE
82      WRITE (6,45) TOTAL (NYR+1), TOTAL (NYR+2), ACTUAL (NYR+1), (IYR(K),
83      *TOTAL (K), ACTUAL (K), K=1, NYR)
84      100 CONTINUE
85      GO TO 200
86      150 WRITE (6,225) CODE, TITLE, ISUB(1), IRC1
87      200 RETURN
88      600 WRITE (6,601)
89      601 FORMAT (5X, 'ERROR IN R=PRNT')
90      RETURN
91      205 FORMAT (1X,/,3(2X,A5,1X,5A4,17X),/)
92      206 FORMAT (1X,/,2(2X,A5,1X,5A4,17X),/)
93      207 FORMAT (1X,/,2X,A5,1X,5A4,17X,/)
94      210 FORMAT (1X,/,3(3X, 'PRESENT VALUE =',F12.2,14X),/,3(3X, 'ANNUAL ',
95      *COST =',F12.2,14X),/,3(3X, 'ACTUAL COSTS =',F12.2,14X),
96      *//,3(3X, 'COSTS BY YEAR',28X),
97      *//,3(3X, 'YEAR',5X, 'PVCOST',5X, 'ACTUAL',15X),/,3(3X, '----',5X,
98      *'-----',5X, '-----',15X),/,50(3(2X,15,1X,F10.2,1X,F10.2,15X),/),
99      */)
100     215 FORMAT (1X,/,2(3X, 'PRESENT VALUE =',F12.2,14X),/,2(3X, 'ANNUAL ',
101     *COST =',F12.2,14X),/,2(3X, 'ACTUAL COSTS =',F12.2,14X),
102     *//,2(3X, 'COSTS BY YEAR',27X),
103     *//,3X,2(2X, 'YEAR',5X, 'PVCOST',5X, 'ACTUAL',16X),/,3X,2(2X, '----',5X
104     *,'-----',5X, '-----',16X),/,50(2(4X,15,1X,F10.2,1X,F10.2,13X),/),
105     */)
106     220 FORMAT (1X,3X, 'PRESENT VALUE =',F12.2,/,3X, 'ANNUAL COST =',
107     *F12.2,/,3X, 'PRESENT VALUE COSTS BY YEAR',/,5X,
108     *'YEAR',10X, 'COST',/,5X, '----',10X, '-----',/,
109     *50(4X,15,2X, '12.2,1X, '10.2,/)
110     222 FORMAT (1X,/,20X, 'SURLEVEL COSTS FOR ',A5,1X,6A4,/)
111     225 FORMAT (1X,/,1X, '*****FPRTR IN TSCUTCH IN R=PRNT =70%./)

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112 +3Y,45,1X,6AQ,/,3X,\*ISUB(1)=\*,I5,3X,\*IRCI=\*,I5,/,/)  
113 END

QPRTS A.SALVAG

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SHCOST(1)-SALVAG

```

1      SUBROUTINE SALVAG
2      INCLUDE PARS
3      C   COMPUTE THE SALVAGE VALUE AFTER NYR
4          IF (IRCL.EQ.0) GO TO 100
5          READ(8,IRCL,ERR=600) ISUB, CODE, TITLE, COST
6          TOTAL(NYR+1)=COST(1)/(1.0+DI-C)*NYR
7          ACTUAL(NYR+1)=COST(1)
8          TOTAL(NYR+2)=TOTAL(NYR+1)*AC=ACT
9          WRITE(8,IRCL,ERR=600) ISUB, CODE, TITLE, COST,
10         *LCOST, TOTAL, ACTUAL
11      100  RETURN
12      600  WRITE(5,601)
13      601  FORMAT(5X, 'ERROR IN SALVAG')
14          RETURN
15          END

```

APRT,S A.SBLNK

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SHCOST(I),SRLNK

```

1      SUBROUTINE SRLNK
2      INCLUDE PARS
3      C   BLANKS OUT OR ZEROS
4      CHARACTER*6 BLNK
5      DATA BLNK/6H      /
6      IF(IJK.EQ.0) GO TO 450
7      DO 100 I=1,K1
8          ISUB(I)=0
9      DO 200 I=1,6
10         TITLE(I)=BLNK
11         CODE=BLNK
12         DO 400 I=1,MCST
13             COST(I)=0.0
14             ACOST(I)=0.0
15             BCOST(I)=0.0
16             CCOST(I)=0.0
17             FLCOST(I)=0.0
18             AFCOST(I)=0.0
19             BFCOST(I)=0.0
20             CFCOST(I)=0.0
21             DFCOST(I)=0.0
22             DCOST(I)=0.0
23         DO 500 I=1,NTOT
24             ACTUAL(I)=0.0
25             BCTUAL(I)=0.0
26             CCTUAL(I)=0.0
27             STOTAL(I)=0.0
28             TOTAL(I)=0.0
29         ATOTAL(I)=0.0
30     RETURN
31     END

```

APRT,S A.SKALE

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SHCOST(1).SKALE

```

1      SUBROUTINE SKALE(A,AMIN,AMAX,ORIG,ALNT,NUM)
2      DIMENSION A(24)
3      DO 10 I=1,NUM
4      10  A(I)=((A(I)-AMIN)/(AMAX-AMIN))*ALNT+ORIG
5      RETURN
6      END

```

APRT,S A.SOLMAN



SHCOST(1).SOLMAN

```

1      INCLUDE PARS.LIST
2      COMMON/SEC/ISECT
3      COMMON/FLAG/IFLG
4      COMMON /NFLT/ FLATE
5      COMMON/PAGE/N1,IPAGNO,LCN1,LCNNT,NAME
6      CHARACTER NAME*30
7      CHARACTER*6 N1,N2,N3,N4
8      1      CONTINUE
9      DEFINE FILE 8(220,K3,V,IOBR)
10     DEFINE FILE 9(25,25,V,IOBR1)
11     CALL SCLOCK(N1,N2,N3,N4)
12     READ(5,101) NAME
13     101    FORMAT(A30)
14     IJK=1
15     C      CALL WBSIN FOR INPUT OF WBS STRUCTURE
16     CALL WBSIN
17     C      CALL CSTDTN FOR INPUT OF COST DATA
18     CALL CSTDTN
19     IF(IPLOTS.NE.0) CALL CALLO
20     C*****
21     C*** IDISC=1 INDICATES INFLATION BEGINS AFTER THE FIRST
22     C*** YEAR OF THE ANALYSIS IDISC/= 1 INDICATES FIRST YEAR
23     C*** INFLATION OF COSTS
24     C*****
25     JYDSC=)
26     IF(IDISC.EQ.1) JYDSC=-1
27     C      COMPUTE SUCCEEDING YEARS IN THE ANALYSIS
28     DO 10 I=1,NYR
29     10     IYR(I)=IYRST+(I-1)
30     LCN1=LCN
31     ISECT=)
32     20     CALL DIVVY
33     ISECT=ISECT+1
34     LNCNT=0
35     IF(IDISC.EQ.-999.) GO TO 130
36     C*****
37     C*** IDISC=1 INDICATES DISCOUNT RATE IS REAL
38     C*** AND INFLATION RATE MUST BE ADDED TO DISC
39     C*** ELSE DISC IS REAL
40     C*****
41     C*****
42     IF(IDISC.EQ.1) DISC=DISC+FLATE
43     C      COMPUTE THE FACTOR USED IN CONVERSION OF PRESENT VALUE TO ANNUAL COST
44     ACFACT=(IDISC*(1.0+DISC)**NYR)/(1.0+DISC)**NYR-1)
45     C      COMPUTE THE AMORTIZED VALUE OF THE LOAN FOR NYRS
46     IF(INRGV.EQ.1) GO TO 50
47     IRC1=IS14
48     IRC2=IS15
49     CALL AMORTZ
50     IRC1=113
51     IRC2=114
52     CALL AMORTZ
53     IJK=0
54     C      COMPUTE THE INFLATED COSTS IF FLATE(INFLATION FACTOR) NOT=0
55     IF (FLATE.EQ.0.0) GO TO 50

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56      IRC1=IS1
57      CALL NPLATE
58      IRC1=IC1
59      CALL NPLATE
60      C  CALL CSTOTO FOR OUTPUT OF COST DATA IN READABLE FORM
61      50  IF (IDATOPT.NE.1) CALL CSTOTO
62      C*****
63      C*** IF ENERGY ANALYSIS ONLY FALL THRU
64      C*** ELSE CONTINUE NORMALLY BY CALLING SOLCST,CNCST
65      C*****
66      IF((INRGV.NE.1) GO TO 100
67      C*****
68      C*** IF COMMERCIAL ENERGY DEDUCTS MUST BE COMPUTED
69      C*** ELSE GO TO ENERGY COSTS
70      C*****
71      IF((ICOM.NE.1) GO TO 90
72      IRC1=0
73      IRC2=0
74      IRC3=0
75      IRC4=IC16
76      CALL DEPIRC
77      IRC4=IS17
78      CALL DEPIRC
79      C*****
80      C*** ENERGY COSTS FOR ENERGY ONLY ANALYSIS
81      C*****
82      99  IRC1=IC7
83      CALL ENERGY
84      IRC1=IS7
85      CALL ENERGY
86      IRC1=IS1
87      C*****
88      C*** TOTAL RESULTS INTO PVAC
89      C*****
90      CALL PVAC
91      IRC1=IC1
92      CALL PVAC
93      GOTO 12C
94      C  CALL SOLCST AND CNCST FOR COMPUTATION OF COSTS FOR
95      C  BOTH THE SOLAR HVAC AND THE CONVENTIONAL HVAC
96      100  IF((IS1.NE.0)CALL SOLCST
97      IF((IC1.NE.0)CALL CNCST
98      C*****
99      C*** COMPUTE LIFE CYCLE COSTS IF REQUESTED
100      C*****
101      120  IF((LFCY.EQ.1) CALL LIFCYC
102      C  CALL RESULT FOR OUTPUT OF THE RESULTS CALCULATED
103      CALL RESULT
104      CALL PDSAVE
105      GO TO 20
106      130  CONTINUE
107      CALL SUNRIZ(IPLTOP)
108      STOP
109      C  DEBUG SUBTRACE,TRACE
110      C  AT 1
111      C  TRACE ON

```

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SHCOST SOURCE LIST

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END

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RPRT.S A.SHCOST

120

# SHCOST SOURCE LIST

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## SHCOST(1).SHCOST

1		CHARACTER=80 DATA
2		CALL CSFREQ('BASG,T 4. .')
3		I=0
4	10	READ(5,100,END=990) DATA
5		I=I+1
6		WRITE(6,200) I,DATA
7	100	FORMAT(A80)
8	200	FORMAT(5X,15,5X,A80)
9		WRITE(4,100) DATA
10		GO TO 10
11	900	CALL CSFREQ('BADD SHCOST,BEGIN .')
12		STOP
13		END

APRT+S A.SOLCST

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SHCOST(1),SOLCST

```

1      SUBROUTINE SOLCST
2      INCLUDE PARS.LIST
3      DIMENSION IST(K1)
4      C   CALLS SUBROUTINES FOR SUMMING LOWER LEVEL DATA, TOTALING DATA IN CERTAIN
5      C   RECORDS, COMPUTING PRESENT VALUE AND ANNUAL COST FOR REP,MAINT,TAXES,ETC
6      CONTINUE
7      C   SUM LOWER LEVEL DATA TO HIGHER LEVEL
8      READ(18,151,ERR=600) IST
9      IF((IS1+IS2+IS3+IS4+IS5+IS6).EQ. 0) GO TO 30
10     IRC1=IS1
11     IRC2=IS6
12     C   CALL SOLSUM
13     C   TOTAL COSTS FOR ACQUISITIONS,BLOG MODS,AND SPACE OCCUPIED
14     30   IF(IS2 .EQ. 0) GO TO 50
15     IRC1=IS2
16     CALL TOTALS
17     50   IF(IS3 .EQ. 0) GO TO 70
18     IRC1=IS3
19     CALL TOTALS
20     70   IF(IS4 .EQ. 0) GO TO 110
21     IRC1=IS4
22     CALL TOTALS
23     C   NET REP COMPUTES YEARLY AND TOTAL COSTS FOR REPLACEMENT AND MAINT
24     110  IF(IS5+IS6.EQ. 0) GO TO 130
25     IRC1=IS5
26     IRC2=IS6
27     CALL NETREP
28     C   ENERGY COMPUTES YEARLY AND TOTAL COSTS FOR EACH FUEL TYPE
29     130  IF(IS7.EQ. 0) GO TO 150
30     IRC1=IS7
31     CALL ENERGY
32     C   TAXCST COMPUTES TAX AND DEDUCTIONS PROPERTY INTEREST ETC
33     150  IF((IS9+IS8+IS12+IS14+IS15 .EQ. 0) GO TO 170
34     IRC1=IS9
35     IRC2=IS8
36     IRC3=IS12
37     IRC4=IS14
38     IRC5=IS15
39     CALL TAXCST
40     C   IF THIS HVAC IS FOR COMMERCIAL USE ADDED INCOME IS COMPUTED
41     C   DEPRECIATION IS ALSO COMPUTED
42     170  IF((IS10+IS11+IS16+IS17 .EQ. 0) GO TO 190
43     IRC1=IS10
44     IRC2=IS11
45     IRC3=IS16
46     IRC4=IS17
47     IF (ICOM.EQ. 1)CALL DEPINC
48     190  IF((IS13 .EQ. 0) GO TO 210
49     IRC1=IS13
50     CALL SALVAG
51     C   COMPUTE TOTAL PV AND AC
52     210  IRC1=IS1
53     CALL PVAC
54     RETURN
55     A90  WRITE(4,A91)

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56 601 FORMAT(5X,'ERROR IN SOLCST')  
57 RETURN  
58 END

APRT.S A.SUNRIZ

SHCOST(1),SUNKIZ

```

1      SUBROUTINE SUNRIZ(IPLTOP)
2      COMMON/SEC/ISECT
3      COMMON/XC/XCNT
4      INTEGER XCNT
5      COMMON/LAST/PRICEL
6      COMMON/NAM/NAMES
7      CHARACTER*63 NAMES
8      DIMENSION CYL(6)
9      DO 8 I=1,ISECT-1
10     READ(7,I,ERR=600) ISECT1,VARY,PCT,G,FLATE1,DISC1
11     *,DNPMT,CSTPSM,TINCOM,PTAX,AREA,SHVAC,CHVAC,CYLF
12     *,PSHAC,PCHAC
13     IF(MOD(I-1,40).NE.0) GO TO 15
14     CALL PAGES(99)
15     WRITE(6,101) NAMES
16     IF(IPLTOP.NE.1) WRITE(6,102) AREA
17     IF(IPLTOP.NE.2) WRITE(6,103) DISC1
18     IF(IPLTOP.NE.3) WRITE(6,104) FLATE1
19     IF(IPLTOP.NE.4) WRITE(6,105) DNPMT
20     IF(IPLTOP.NE.5) WRITE(6,106) PTAX
21     IF(IPLTOP.NE.6) WRITE(6,107) TINCOM
22     WRITE(6,108) CSTPSM
23     IF(IPLTOP.EQ.1) WRITE(6,109)
24     IF(IPLTOP.EQ.2) WRITE(6,110)
25     IF(IPLTOP.EQ.3) WRITE(6,111)
26     IF(IPLTOP.EQ.4) WRITE(6,112)
27     IF(IPLTOP.EQ.5) WRITE(6,113)
28     IF(IPLTOP.EQ.6) WRITE(6,114)
29     WRITE(6,115)
30     15    WRITE(6,100) ISECT1,VARY,PCT,G
31     *,SHVAC,CHVAC,PSHAC,PCHAC,CYLF
32     8      CONTINUE
33     RETURN
34     600    WRITE(6,601)
35     601    FORMAT(5X,'ERROR IN SUNRIZ')
36     RETURN
37     101    FORMAT(T64,'SUMMARY',//,T55,A63,////)
38     115    FORMAT(//,' SECT',5X,'VARY PERCENT TOTAL',7X,'ACTUAL COST'
39     +PRESENT VAL COST',7X,'LIFE CYCLE COST SAVINGS',7X,'LIFE CYCLE FUEL
40     + COST',/, ' NO',14X,'LOAD',5X,'LOAD SHVAC',6X,'CHVAC SHVAC',
41     + 5X,'CHVAC PRESENT',5X,'ACTUAL ANNUAL PRESENT ACTUAL
42     +ANNUAL',/,2X,4(' '),2X,8(' '),2X,6(' '),2X,7(' '),3X,8(' '),1X,
43     +8(' '),2X,8(' '),1X,8(' '),3X,5(8(' '),2X,8(' '))
44     100    FORMAT(1X,15,2X,F4.1,2X,F5.2,'%',2X,F7.2,2X,2F9.2,1X,2F9.2,
45     +2X,5(F9.2,1X),F9.2)
46     102    FORMAT(T54,'COLLECTOR AREA = ',F6.2,'GJ/YR')
47     103    FORMAT(T54,'DISCOUNT RATE = ',F6.2,'%')
48     104    FORMAT(T54,'INFLATION RATE = ',F6.2,'%')
49     105    FORMAT(T54,'DOWNPAYMENT = ',F6.2,'%')
50     106    FORMAT(T54,'PROPERTY TAX RATE = ',F6.2,'%')
51     107    FORMAT(T54,'INCOME TAX RATE = ',F6.2,'%')
52     108    FORMAT(T54,'COST PER SQ. METER $',F6.2)
53     109    FORMAT(T46,'FOR THIS CASE, VARY IS THE COLLECTOR AREA. GJ/YR')
54     110    FORMAT(T46,'FOR THIS CASE, VARY IS THE DISCOUNT RATE. %')
55     111    FORMAT(T46,'FOR THIS CASE, VARY IS THE INFLATION RATE. %')

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56 112 FORMAT(T96,'FOR THIS CASE, VARY IS THE DOWNPAYMENT. 8')  
57 113 FORMAT(T96,'FOR THIS CASE, VARY IS THE PROPERTY TAX RATE. 8')  
58 114 FORMAT(T96,'FOR THIS CASE, VARY IS THE INCOME TAX RATE. 8')  
59 END

APRT.S A.TAXCST

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SH=COST(1),TAXCST

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1      SUBROUTINE TAXCST
2      INCLUDE PARS
3      COMMON /NFLT/ FLATE
4      CALL SBLNK
5      IF(IRC2.EQ.0) GO TO 10
6      C   COMPUTE PROPERTY TAX AND DEDUCTIONS
7      C   COST(1 THRU NYR)= ASSESSED VALUE OF HVAC IN YEAR J
8      C   COST(2)= PROPERTY TAX RATE
9      READ(8*IRC2,ERR=600) ISUB, CODE, TITLE, COST,
10     +FLCOST
11     10   IF(IRC2.EQ.0) GO TO 150
12     READ(8*IRC1,ERR=600) ISA, ACODE, ATITLE, ACOST,
13     +AFCOST
14     IF (COST(2) .GT. 0.0 .AND. ACOST(2) .GT. 0.0 .AND.
15     +ACOST(3) .GT. 0.0) GO TO 50
16     C   WRITE(6,300)
17     GO TO 150
18     50   DO 133 I=1,NYR
19     IF(FLATE.EQ.0.0) ACTUAL(I)=COST(2)*COST(1)
20     IF(FLATE.NE.0.0) ACTUAL(I)=COST(2)*FLCOST(I)
21     TOTAL(I)=ACTUAL(I)/(1.0+DISC)**I
22     TOTAL(NYR+1)=TOTAL(NYR+1)+TOTAL(I)
23     ATOTAL(I)=ACOST(3)+TOTAL(I)
24     ATOTAL(NYR+1)=ATOTAL(NYR+1)+ATOTAL(I)
25     BCTUAL(I)=ACOST(3)+ACTUAL(I)
26     ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(I)
27     BCTUAL(NYR+1)=BCTUAL(NYR+1)+BCTUAL(I)
28     130   CONTINUE
29     TOTAL(NYR+2)=TOTAL(NYR+1)+ACFACT
30     ATOTAL(NYR+2)=ATOTAL(NYR+1)+ACFACT
31     WRITE(8*IRC1,ERR=600) ISA, ACODE, ATITLE,
32     +ACOST, AFCOST, ATOTAL, BCTUAL
33     WRITE(8*IRC2,ERR=600) ISUB, CODE, TITLE,
34     +COST, FLCOST, TOTAL, ACTUAL
35     150   CALL SBLNK
36     IF(IRC3.EQ.0) GO TO 170
37     C   COMPUTE INSURANCE COSTS
38     READ(8*IRC3,ERR=600) ISUB, CODE, TITLE, COST,
39     +FLCOST
40     C   COST(1)=ANNUAL PREMIUMS COST(2)=ANNUAL DAMAGE COST(3)=REIMBURSEMENTS
41     TOTAL(NYR+2)=COST(1)+COST(2)-COST(3)
42     DO 163 J=1,NYR
43     ACTUAL(J)=TOTAL(NYR+2)
44     ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(J)
45     160   CONTINUE
46     TOTAL(NYR+1)=TOTAL(NYR+2)/ACFACT
47     WRITE(8*IRC3,ERR=600) ISUB, CODE, TITLE, COST,
48     +FLCOST, TOTAL, ACTUAL
49     CALL SBLNK
50     170   IF(IRC4+IRC5.EQ.0) GO TO 250
51     READ(8*IRC4,ERR=600) ISUB, CODE, TITLE, COST,
52     +FLCOST
53     READ(8*IRC5,ERR=600) ISA, ACODE, ATITLE, ACOST,
54     +AFCOST
55     IF (ACOST(2) .GT. 0.0 .AND. COST(2) .GT. 0.0) GO TO 130

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56      C      WRITE(6,310)
57      GO TO 250
58      C      COST(1) THRU COST(NYR) =OUTSTANDING MORTGAGE
59      C      COST(2)= MARKET RATE
60      C      COST(3)=INCOME TAX RATE
61      190 DO 200 I=1,NYR
62          ACTUAL(I)=COST(I)*COST(NYR+1)*COST(NYR+2)
63          ACTUAL(NYR+1)=ACTUAL(NYR+1)+ACTUAL(I)
64          TOTAL(I)=ACTUAL(I)/(1.0+DISC)**I
65          BCTUAL(I)=ACOST(I)
66          ATOTAL(I)=BCTUAL(I)/(1.0+DISC)**I
67          BCTUAL(NYR+1)=BCTUAL(NYR+1)+BCTUAL(I)
68          ATOTAL(NYR+1)=ATOTAL(NYR+1)+ATOTAL(I)
69      200    TOTAL(NYR+1)=TOTAL(NYR+1)+TOTAL(I)
70          ATOTAL(NYR+2)=ATOTAL(NYR+1)*ACFACT
71          TOTAL(NYR+2)=TOTAL(NYR+1)*ACFACT
72          WRITE(8'IRC4,ERR=600) ISUB,CODE,TITLE,COST,
73          +FLCOST,TOTAL,ACTUAL
74          WRITE(8'IRC5,ERR=600) ISA,ACODE,ATITLE,ACOST,
75          +ACOST,ATOTAL,BCTUAL
76      250 RETURN
77      600 WRITE(6,691)
78      601 FORMAT(5X,'ERROR IN TAXCST')
79      RETURN
80      C 300 FORMAT(1H1,3X,'THE VALUE OF THE PROPERTY TAX RATE OR THE INCOME',
81      C      +/,3X,'TAX RATE FOR PROPERTY TAX CALCULATIONS WAS ZERO. THE',/,3X,
82      C      +',CALCULATIONS FOR PROPERTY TAX AND PROP TAX DEDUCTIONS WERE NOT',/,
83      C      +3X,'PERFORMED',/)
84      C 310 FORMAT(1H1,3X,'THE VALUE OF THE INCOME TAX RATE OR THE MARKET',/,
85      C      +3X,'INTEREST RATE WAS ZERO. CALCULATIONS FOR DEDUCTIONS OR',/,3X,
86      C      +',THE LOAN INTEREST WERE NOT PERFORMED.',/)
87      END

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3PRT,5 A.TOTALS

SHCOST(1).TOTALS

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1      SUBROUTINE TOTALS
2      INCLUDE PARS
3      C    TOTALS ALL COST ACC BLDG, AND SPACE VALUE GOES TO TOTALS
4      1    CONTINUE
5          IF((IRC1.EQ.0) GO TO 100
6          CALL SBLNK
7          KAT1=6
8          KAT2=IRC1
9          READ(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST,
10         *FLCOST
11          IF((ISUB(2).GT.0 .AND. COST(1).LE.0) GO TO 20
12          DO 10 J=1, NYR
13      10    TOTAL(NYR+1)=TOTAL(NYR+1)+COST(J)
14          ACTUAL(NYR+1)=TOTAL(NYR+1)
15          GO TO 50
16      C    SUM COSTS FOR EACH LEVEL
17      20    DO 40 I=2, K1
18          IF((ISUB(I).LE.0) GOTO 40
19          ATOTAL(NYR+1)=0.0
20          KAT1=17
21          KAT2=ISUB(I)
22          READ(8*ISUB(I),ERR=600) ISA, ACODE, ATITLE,
23         *ACOST, AFCOST
24          DO 30 J=1, NYR
25      30    ATOTAL(NYR+1)=ATOTAL(NYR+1)+ACOST(J)
26          BCTUAL(NYR+1)=ATOTAL(NYR+1)
27          ATOTAL(NYR+3)=ATOTAL(NYR+1)+DWNPMT
28          ATOTAL(NYR+2)=ATOTAL(NYR+1)+ACFACT*DWNPMT
29          KAT1=36
30          KAT2=ISUB(I)
31          WRITE(8*ISUB(I),ERR=600) ISA, ACODE, ATITLE,
32         *ACOST, AFCOST, ATOTAL, BCTUAL
33          TOTAL(NYR+1)=TOTAL(NYR+1)+ATOTAL(NYR+1)
34          ACTUAL(NYR+1)=ACTUAL(NYR+1)+BCTUAL(NYR+1)
35      40    CONTINUE
36      50    TOTAL(NYR+3)=TOTAL(NYR+1)+DWNPMT
37          TOTAL(NYR+2)=TOTAL(NYR+1)+ACFACT*DWNPMT
38          WRITE(8*IRC1,ERR=600) ISUB, CODE, TITLE, COST,
39         *FLCOST, TOTAL, ACTUAL
40      100    RETURN
41      600    WRITE(6,601) KAT1, KAT2
42      601    FORMAT(5X, 'ERROR IN TOTALS', 2I10)
43          RETURN
44      C    DEBUG TRACE, SUBTRACE, INIT
45      C    AT 1
46      C    TRACE ON
47      END

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@PRT,S A-TABLE

SHCOST(1).TABLE

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1  SUBROUTINE TABLE(I,J,PA,PB,PC,PD,PE,PF,NAME,L)
2  COMMON/CITYS/NAMES(151)
3  INTEGER AX(2,151)
4  INTEGER BX(2,151),CX(2,151),DX(2,151),EX(2,151),FX(2,151)
5  REAL LO(151),L
6  DIMENSION A(2,151),B(2,151),C(2,151),
7  *          D(2,151),E(2,151),F(2,151)
8  CHARACTER*63 NAMES,NAME
9  DATA (NAMES(I),I=1,10)/
10 * 'AGILENE, TEXAS
11 * 'ALBANY, NEW YORK
12 * 'ALBUQUERQUE, NEW MEXICO
13 * 'AMARILLO, TEXAS
14 * 'AMES, IOWA
15 * 'AMHERST, MASSACHSETTS
16 * 'ANNAPOLIS, MARYLAND
17 * 'APALACHICOLA, FLORIDA
18 * 'ASHVILLE, NORTH CAROLINA
19 * 'ASTORIA, OREGON
20 **/
21 DATA (NAMES(I),I=11,20)/
22 * 'ATLANTA, GEORGIA
23 * 'ATLANTIC CITY, NEW JERSEY
24 * 'BIG SPINGS, TEXAS
25 * 'BILLINGS, MONTANA
26 * 'BINGHAMPTON, NEW YORK
27 * 'BIRMINGHAM, ALABAMA
28 * 'BISMARCK, NORTH DAKOTA
29 * 'BLUE HILL, MASSACHSETTS
30 * 'BOISE, IDAHO
31 * 'BOSTON, MASSACHSETTS
32 **/
33 DATA (NAMES(I),I=21,30)/
34 * 'BOULDER, COLORADO
35 * 'BROWNSVILLE, TEXAS
36 * 'CAPE HATTERAS, NORTH CAROLINA
37 * 'CARILBOU, MAINE
38 * 'CHARLESTON, SOUTH CAROLINA
39 * 'CHAROLLE, NORTH CAROLINA
40 * 'CHATTANOOGA, TENNESSEE
41 * 'CHICAGO, ILLINOIS
42 * 'CLEVELAND, OHIO
43 * 'COLUMBIA, MISSOURI
44 **/
45 DATA (NAMES(I),I=31,40)/
46 * 'COLUMBUS, OHIO
47 * 'CORPUS CHRISTI, TEXAS
48 * 'CORVALLIS, OREGON
49 * 'DALLAS, TEXAS
50 * 'DAVIS, CALIFORNIA
51 * 'DAYTON, OHIO
52 * 'DENVER, COLORADO
53 * 'DES MOINES, IOWA
54 * 'DETROIT, MICHIGAN
55 * 'DODGE CITY, KANSAS

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56      **/
57      DATA (NAMES(I),I=41,50)/
58      *   *DULUTH, MINNESOTA
59      **, *EAST LANSING, MICHIGAN
60      **, *EL PASO, TEXAS
61      **, *ELY, NEVADA
62      **, *FARGO, NORTH DAKOTA
63      **, *FORT SMITH, ARKANSAS
64      **, *FORT WAYNE, INDIANA
65      **, *FORT WORTH, TEXAS
66      **, *FRESNO, CALIFORNIA
67      **, *GAINSVILLE, FLORIDA
68      **/
69      DATA (NAMES(I),I=51,60)/
70      *   *GLASGOW, MONTANA
71      **, *GRAND JUNCTION, COLORADO
72      **, *GRAND LAKE, COLORADO
73      **, *GREAT FALLS, MONTANA
74      **, *GREEN BAY, WISCONSIN
75      **, *GREENSBORO, NORTH CAROLINA
76      **, *GREENVILLE-SPARTANBURG, NORTH CAROLINA
77      **, *GRIFFIN, GEORGIA
78      **, *HARTFORD, CONNECTICUT
79      **, *HOUSTON, TEXAS
80      **/
81      DATA (NAMES(I),I=61,70)/
82      *   *INDIANAPOLIS, INDIANA
83      **, *INYOKEPN, CALIFORNIA
84      **, *ITHICA, NEW YORK
85      **, *JACKSON, MISSISSIPPI
86      **, *JACKSONVILLE, FLORIDA
87      **, *KANSAS CITY, MISSOURI
88      **, *KEY WEST, FLORIDA
89      **, *LAKE CHARLES, LOUISIANA
90      **, *LANDER, WYOMING
91      **, *LANSING, MICHIGAN
92      **/
93      DATA (NAMES(I),I=71,80)/
94      *   *LAPAMIE, WEST VIRGINIA
95      **, *LAS VEGAS, NEVADA
96      **, *LEMONT ILLINOIS
97      **, *LEXINGTON, KENTUCKY
98      **, *LINCOLN, NEBRASKA
99      **, *LITTLE ROCK, ARKANSAS
100     **, *LOS ANGELES, CALIFORNIA
101     **, *LOUISVILLE, KENTUCKY
102     **, *LYNN, MASSACHSETTS
103     **, *MACON, GEORGIA
104     **/
105     DATA (NAMES(I),I=81,90)/
106     *   *MADISON, WISCONSIN
107     **, *MANHATTAN, KANSAS
108     **, *MEDFORD, OREGON
109     **, *MEMPHIS, TENNESSEE
110     **, *MIAMI, FLORIDA
111     **, *MILWAUKEE, WISCONSIN

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112 \*\*,\*MILWAUKEE, WISCONSIN  
 113 \*\*,\*MINN.-ST. PAUL, MINNISOTA  
 114 \*\*,\*MT. WEATHER, WEST VIRGINIA  
 115 \*\*,\*NASHVILLE, TENNESSEE  
 116 \*\*/  
 117 DATA (NAMES(I),I=91,100)/  
 118 \* ,\*NATICK, MASSACHSETTS  
 119 \*\*,\*NEW ORLEANS, LOUISIANA  
 120 \*\*,\*NEWPORT, RHODE ISLAND  
 121 \*\*,\*NEW YORK, NEW YORK  
 122 \*\*,\*NORFOLK, VIRGINIA  
 123 \*\*,\*NORTH OMAHA, NEBRASKA  
 124 \*\*,\*OAK RIDGE, TENNESSEE  
 125 \*\*,\*OKLAHOMA CITY, OKLAHOMA  
 126 \*\*,\*PAGE, OREGON  
 127 \*\*,\*PARKERSBURG, WEST VIRGINIA  
 128 \*\*/  
 129 DATA (NAMES(I),I=101,110)/  
 130 \* ,\*PASADENA, CALIFORNIA  
 131 \*\*,\*PENSICOLA, FLORIDA  
 132 \*\*,\*PEORIA, ILLINOIS  
 133 \*\*,\*PHOENIX, ARIZONA  
 134 \*\*,\*PHILADELPHIA, PENNSYLVANIA  
 135 \*\*,\*PITTSBURGH, PENNSYLVANIA  
 136 \*\*,\*PORTELLO, IDAHO  
 137 \*\*,\*PORT AUTHOR, TEXAS  
 138 \*\*,\*PORTLAND, MAINE  
 139 \*\*,\*PORTLAND, OREGON  
 140 \*\*/  
 141 DATA (NAMES(I),I=111,120)/  
 142 \* ,\*PROSSER, WEST VIRGINIA  
 143 \*\*,\*PUEBLO, COLORADO  
 144 \*\*,\*PULLMAN, WEST VIRGINIA  
 145 \*\*,\*PUF-IN-BAY, OHIO  
 146 \*\*,\*RALEIGH, NORTH CAROLINA  
 147 \*\*,\*RALEIGH-DURHAM, NORTH CAROLINA  
 148 \*\*,\*RAPID CITY, SOUTH DAKOTA  
 149 \*\*,\*RENO, NEVADA  
 150 \*\*,\*RICHLAND, WEST VIRGINIA  
 151 \*\*,\*RICHMOND, VIRGINIA  
 152 \*\*/  
 153 DATA (NAMES(I),I=121,130)/  
 154 \* ,\*RIVERSTOE, CALIFORNIA  
 155 \*\*,\*ROCHESTER, NEW YORK  
 156 \*\*,\*SACRAMENTO, CALIFORNIA  
 157 \*\*,\*ST. CLOUD, MINNISOTA  
 158 \*\*,\*ST. LOUIS, MISSOURI  
 159 \*\*,\*SALT LAKE CITY, UTAH  
 160 \*\*,\*SAN ANTONIO, TEXAS  
 161 \*\*,\*SAN DIEGO, CALIFORNIA  
 162 \*\*,\*SAN FRANCISCO, CALIFORNIA  
 163 \*\*,\*SAN JOSE, CALIFORNIA  
 164 \*\*/  
 165 DATA (NAMES(I),I=131,140)/  
 166 \* ,\*SANTA MARIA, CALIFORNIA  
 167 \*\*,\*SAVANNAH, GEORGIA

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168 \*\*SAULT ST. MARIE, MICHIGAN  
 169 \*\*SCHEMENECEADY, NEW YORK  
 170 \*\*SEATTLE, WASHINGTON  
 171 \*\*SHREVEPORT, LOUISIANA  
 172 \*\*SILVER HILL, MARYLAND  
 173 \*\*SPOKANE, WASHINGTON  
 174 \*\*STATE COLLEGE, PENNSYLVANIA  
 175 \*\*STILLWATER, OKLAHOMA  
 176 \*\*  
 177 DATA (NAMES(I),I=141,151)/  
 178 \* SUMMIT, MONTANA  
 179 \*\*SYRACUSE, NEW YORK  
 180 \*\*TALLAHASSEE, FLORIDA  
 181 \*\*TAMPA, FLORIDA  
 182 \*\*TRENTON, NEW JERSEY  
 183 \*\*TUCSON, ARIZONA  
 184 \*\*TULSA, OKLAHOMA  
 185 \*\*TWIN FALLS, IDAHO  
 186 \*\*WASHINGTON, DC  
 187 \*\*WICHITA, KANSAS  
 188 \*\*YUMA, ARIZONA  
 189 \*\*  
 190 DATA (A(I,I),AX(I,I),I=1,60)/  
 191 .4466,-01.,1290,-01.,3606,-01.,3374,-01.,1365,-01.,9909,-02.  
 192 1.1796,-01.,7649,-01.,2581,-01.,1676,-01.,3001,-01.,2042,-01.  
 193 2.4541,-01.,1653,-01.,1042,-01.,3151,-01.,1353,-01.,1274,-01.  
 194 3.1899,-01.,1211,-01.,2115,-01.,9212,-01.,4393,-01.,1064,-01.  
 195 4.4031,-01.,3105,-01.,2447,-01.,1337,-01.,1363,-01.,1833,-01.  
 196 5.1245,-01.,8408,-01.,1575,-01.,4056,-01.,3043,-01.,1444,-01.  
 197 6.2468,-01.,1311,-01.,1106,-01.,2709,-01.,1227,-01.,9811,-02.  
 198 7.5001,-01.,2227,-01.,9665,-02.,2512,-01.,1369,-01.,4531,-01.  
 199 8.4164,-01.,7786,-01.,1512,-01.,2431,-01.,1623,-01.,1613,-01.  
 200 9.1621,-01.,2464,-01.,3135,-01.,3709,-01.,1439,-01.,6308,-01/  
 201 DATA (A(I,I),AX(I,I),I=61,120)/  
 202 A.1271,-01.,7724,-01.,8764,-02.,3794,-01.,6445,-01.,1760,-01.  
 203 1.1139,-01.,6319,-01.,2095,-01.,1048,-01.,1702,-01.,5582,-01.  
 204 2.1310,-01.,2059,-01.,1748,-01.,2563,-01.,6201,-01.,1648,-01.  
 205 3.1117,-01.,4441,-01.,1191,-01.,1824,-01.,1031,-01.,2655,-01.  
 206 4.1063,-01.,4735,-01.,1167,-01.,1000,-01.,1646,-01.,2005,-01.  
 207 5.1369,-01.,4925,-01.,1577,-01.,1147,-01.,2673,-01.,1683,-01.  
 208 6.1960,-01.,3150,-01.,1114,-01.,1352,-01.,6335,-01.,6056,-01.  
 209 7.1343,-01.,9164,-01.,1793,-01.,1535,-01.,1877,-01.,5613,-01.  
 210 8.1454,-01.,1304,-01.,1951,-01.,2786,-01.,1649,-01.,1027,-01.  
 211 9.2876,-01.,2760,-01.,1878,-01.,2868,-01.,1570,-01.,2233,-01/  
 212 DATA (A(I,I),AX(I,I),I=121,151), (A(2,I),I=1,29)/  
 213 A.8447,-01.,1145,-01.,1031,-01.,1211,-01.,1794,-01.,1825,-01.  
 214 1.6537,-01.,5838,-01.,3631,-01.,4341,-01.,4402,-01.,4406,-01.  
 215 2.1154,-01.,8697,-02.,1405,-01.,1886,-01.,1995,-01.,1448,-01.  
 216 3.1112,-01.,2737,-01.,1014,-01.,9747,-02.,6411,-01.,8724,-01.  
 217 4.1006,-01.,8232,-01.,2449,-01.,1678,-01.,1804,-01.,2305,-01.  
 218 5.1080,-01.,6434,-01.,1488,-01.,5337,-01.,4801,-01.,1837,-01.  
 219 1.1399,-01.,2537,-01.,1107,-01.,1604,-01.,2193,-01.,4365,-01.  
 220 2.2882,-01.,6539,-01.,2337,-01.,1380,-01.,4460,-01.,1867,-01.  
 221 3.1737,-01.,2632,-01.,1641,-01.,1039,-01.,1498,-01.,6306,-01.  
 222 4.1426,-01.,7034,-01.,4513,-01.,3425,-01.,1830,-01.,1356,-01/  
 223 DATA (A(I,I),AX(I,I),I=152,151)/

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224 5.2561.-01..1648.-01..1267.-01..2024.-01..5034.-01..5362.-01.  
 225 6.2002.-01..3584.-01..1813.-01..1456.-01..6843.-01..1348.-01.  
 226 7.1390.-01..8370.-01..3747.-01..1320.-01..3549.-01..1770.-01.  
 227 8.6511.-01..5837.-01..1184.-00..2138.-01..3445.-01..2300.-01.  
 228 9.2279.-01..1366.-01..3461.-01..4438.-01..5279.-01..1993.-01.  
 229 A.9176.-01..1701.-01..1183.-01..1157.-01..5790.-01..9650.-01.  
 230 1.2473.-01..1722.-00..9240.-01..3026.-01..1413.-01..2468.-01.  
 231 2.8061.-01..1815.-01..2899.-01..2441.-01..3609.-01..9270.-01.  
 232 3.2237.-01..1418.-01..6387.-01..1605.-01..2554.-01..2412.-01.  
 233 4.3744.-01..1611.-01..6817.-01..1573.-01..1369.-01..2288.-01/  
 234 DATA (4(2,1),AX(2,1),I=93,151)/  
 235 5.2783.-01..1862.-01..7253.-01..2215.-01..1572.-01..3764.-01.  
 236 6.2351.-01..2668.-01..4443.-01..4499.-01..1797.-01..9371.-01.  
 237 7.8887.-01..1857.-01..1364.-00..2385.-01..2100.-01..2604.-01.  
 238 8.8113.-01..2728.-01..1675.-01..2605.-01..4213.-01..2203.-01.  
 239 9.1374.-01..4214.-01..3843.-01..2684.-01..4129.-01..2054.-01.  
 240 A.1122.-01..1035.-00..1543.-01..5197.-01..1672.-01..2476.-01.  
 241 1.2519.-01..2561.-01..8889.-01..5538.-01..6154.-01..7396.-01.  
 242 2.7216.-01..1478.-01..1134.-01..1178.-01..5555.-01..2767.-01.  
 243 3.1942.-01..1465.-01..3867.-01..8295.-01..1276.-01..9601.-01.  
 244 4.1331.-00..2504.-01..1212.-00..3462.-01..2255.-01..2495.-01.  
 245 5.3230.-01..1635.-00/  
 246 DATA (9(1,1),BX(1,1),I=1,53)/  
 247 1-1840.-02..8575.-03..1093.-02..1107.-02..8160.-03.  
 248 1-2562.-03..1143.-02..3374.-02..1252.-02..1461.-02.  
 249 2-1597.-02..1060.-02..1889.-02..7642.-03..9153.-03.  
 250 3-1767.-02..7344.-03..8961.-03..1143.-02..9823.-03.  
 251 4-8627.-03..2870.-02..1798.-02..7104.-03..2478.-02.  
 252 5-1549.-02..1486.-02..9110.-03..1391.-02..1084.-02.  
 253 6-1113.-02..3511.-02..1550.-02..2037.-02..2289.-02.  
 254 7-1343.-02..7793.-03..8789.-03..1325.-02..9953.-03.  
 255 8-7816.-03..9407.-03..1734.-02..6523.-03..7276.-02.  
 256 9-1470.-02..9779.-03..1958.-02..2102.-02..2888.-02/  
 257 DATA (8(1,1),BX(1,1),I=51,100)/  
 258 4-6820.-03..9295.-03..6358.-03..8334.-03..8301.-03.  
 259 5-1335.-02..1576.-02..1804.-02..8335.-03..3375.-02.  
 260 6-1098.-02..1351.-02..9620.-03..2396.-02..3125.-02.  
 261 1-1066.-02..6171.-03..3320.-02..6305.-03..8649.-03.  
 262 2-5775.-03..1736.-02..9135.-03..1176.-02..1008.-02.  
 263 3-1553.-02..1885.-02..1738.-02..1062.-02..2144.-02.  
 264 4-8735.-03..9951.-03..1411.-02..1561.-02..6333.-03.  
 265 5-1819.-02..8812.-03..8019.-03..9149.-03..1489.-02.  
 266 6-9331.-03..3253.-02..3538.-03..1118.-02..1412.-02.  
 267 7-8824.-03..1455.-02..1301.-02..9061.-03..1242.-02/  
 268 DATA (9(1,1),BX(1,1),I=131,150)/  
 269 8-2183.-02..3232.-02..9927.-03..2835.-02..1084.-01.  
 270 9-1087.-02..9566.-01..3261.-02..7919.-03..1427.-02.  
 271 7-1251.-02..8491.-03..1116.-02..9663.-03..1366.-02.  
 272 8-1377.-02..7423.-03..8308.-03..1399.-02..1306.-02.  
 273 1-2348.-02..9425.-03..1398.-02..6769.-03..1169.-02.  
 274 2-1339.-02..3331.-02..1934.-02..5952.-03..2223.-02.  
 275 3-1060.-02..2568.-02..8043.-03..8778.-03..1564.-02.  
 276 4-2192.-02..1212.-02..1323.-02..1032.-02..1346.-02.  
 277 5-8722.-03..9759.-03..2808.-02..1607.-02..1065.-02.  
 278 6-2683.-02..1332.-02..1314.-02..1217.-02..1129.-02/  
 279 DATA (1(1,1),BX(1,1),I=12,11,RY(2,1),I=9,83)/



280 0-.2809-.02-.2886-.02-.1492-.02-.1726-.02-.1827-.02,  
281 1-.1346-.32-.1536-.02-.1899-.32-.4835-.32-.1959-.02,  
282 2-.1269-.02-.2570-.02-.1863-.02-.3010-.02-.1349-.02,  
283 3-.1402-.32-.2880-.02-.1162-.32-.1500-.32-.1840-.02,  
284 4-.1620-.02-.1465-.02-.4746-.02-.2893-.02-.1189-.02,  
285 5-.3768-.32-.5211-.02-.2411-.32-.1491-.02-.1665-.02,  
286 6-.1796-.02-.1715-.02-.5557-.02-.2392-.02-.3311-.02,  
287 7-.3536-.02-.1667-.02-.1263-.32-.1443-.02-.1584-.32,  
288 8-.1639-.02-.1711-.02-.1478-.02-.2676-.02-.1115-.32,  
289 9-.1199-.32-.2463-.02-.1618-.32-.3142-.32-.3055-.02/  
290 DATA (B(2,1),BX(2,1),I=1,99)/  
291 A-.4673-.32-.1157-.02-.4995-.32-.1370-.02-.1336-.02,  
292 B-.1333-.02-.2189-.02-.2580-.02-.2820-.02-.1380-.02,  
293 C-.5259-.32-.1711-.02-.3377-.32-.1445-.02-.3449-.02,  
294 D-.4454-.02-.1756-.02-.2641-.03-.5247-.02-.1024-.02,  
295 E-.1469-.32-.1380-.02-.2745-.32-.1494-.02-.1390-.02,  
296 F-.1550-.02-.2611-.02-.3031-.02-.1913-.02-.1697-.02,  
297 G-.1450-.02-.1339-.02-.1668-.32-.2315-.02-.2621-.02,  
298 H-.9134-.03-.2922-.02-.1446-.02-.1294-.02-.1538-.02,  
299 I-.2292-.02-.1130-.32-.5185-.32-.1620-.32-.1845-.02,  
300 J-.2305-.02-.1360-.03-.2240-.02-.2120-.02-.1432-.02/  
301 DATA (B(2,1),BX(2,1),I=100,151)/  
302 B-.1897-.02-.3622-.02-.5027-.02-.1577-.02-.4556-.02,  
303 C-.1789-.02-.1768-.02-.1534-.32-.5013-.02-.1379-.02,  
304 A-.2167-.02-.2053-.02-.1434-.02-.1036-.02-.1624-.02,  
305 B-.2139-.02-.2243-.02-.1203-.02-.1439-.02-.2164-.02,  
306 C-.2131-.02-.3570-.02-.1543-.02-.3353-.02-.1107-.02,  
307 D-.1876-.32-.1669-.02-.4641-.32-.3333-.32-.1432-.32,  
308 E-.3665-.02-.1834-.02-.3963-.02-.1325-.02-.1400-.02,  
309 F-.2485-.32-.3563-.32-.1785-.02-.1665-.02-.1595-.02,  
310 G-.2237-.02-.1307-.02-.1519-.02-.4361-.02-.1951-.02,  
311 H-.1754-.02-.4146-.02-.2179-.02-.1688-.02-.2014-.02,  
312 I-.1797-.02-.4248-.02/  
313 DATA (C(1,1),CX(1,1),I=1,59)/  
314 A-.1183-.04-.8409-.05-.7717-.05-.3930-.06-.1568-.04,  
315 B-.4698-.05-.3146-.05-.7428-.35-.2569-.34-.4538-.05,  
316 C-.2226-.05-.2441-.05-.6195-.05-.1416-.05-.2741-.05,  
317 D-.1439-.05-.2395-.04-.1329-.04-.1559-.04-.1134-.04,  
318 E-.4025-.06-.4029-.04-.1209-.04-.1758-.04-.4184-.04,  
319 F-.2513-.06-.7423-.05-.1135-.34-.5355-.35-.1486-.35,  
320 A-.1323-.04-.1428-.04-.3636-.05-.1724-.04-.2977-.04,  
321 B-.1895-.36-.8975-.35-.8343-.35-.1235-.04-.6475-.35,  
322 C-.1318-.04-.1145-.04-.8989-.06-.3629-.05-.1874-.05,  
323 D-.9337-.05-.3275-.05-.2241-.34-.1202-.34-.6966-.35/  
324 DATA (C(1,1),CX(1,1),I=51,100)/  
325 A-.7214-.35-.2149-.04-.5638-.06-.1366-.34-.3193-.35,  
326 B-.4784-.05-.1850-.05-.3921-.05-.2677-.04-.3746-.04,  
327 C-.1625-.34-.3133-.04-.1258-.34-.1349-.04-.2419-.04,  
328 D-.6036-.05-.6758-.05-.2870-.04-.2441-.05-.1361-.05,  
329 E-.8726-.05-.4747-.05-.7720-.36-.8363-.07-.2425-.34,  
330 F-.1259-.04-.1011-.04-.0.1778-.04-.1019-.04-.1041-.04,  
331 G-.1378-.34-.4470-.06-.7548-.36-.7334-.35-.6621-.34,  
332 H-.3879-.05-.5096-.05-.3437-.05-.2144-.04-.2204-.04,  
333 I-.1013-.34-.4851-.35-.7771-.35-.4283-.37-.5594-.35,  
334 J-.1854-.04-.7743-.05-.1707-.04-.7686-.05-.1619-.04/  
335 DATA (C(1,1),CX(1,1),I=101,151)/

336 9+.9446,-05,-.2633,-04,-.3445,-05,-.1515,-04,-.1802,-04,  
337 A-.7393,-05,-.2662,-05,-.3324,-04,-.1293,-04,-.2526,-05,  
338 B-.8884,-05,-.2233,-05,-.1322,-04,-.3953,-05,-.1487,-04,  
339 0-.2577,-04,-.1418,-04,-.1878,-05,-.2367,-05,-.4345,-06,  
340 1-.1311,-04,-.4870,-05,-.3334,-06,-.1717,-04,-.1901,-04,  
341 2-.2000,-04,-.2160,-04,-.9571,-05,-.2176,-04,-.3513,-04,  
342 3+.4434,-04,-.2125,-04,-.2355,-04,-.1944,-05,-.3860,-04,  
343 4+.1245,-04,-.1058,-04,-.1898,-04,-.8879,-05,-.7877,-05,  
344 5-.1574,-04,-.4787,-05,-.1310,-04,-.2516,-04,-.1095,-04,  
345 6+.1045,-04,-.6363,-05,-.3673,-04,-.3038,-06,-.2002,-04/  
346 DATA C(1,151),CX(1,151),(C(2,1),CX(2,1),I=1,49)/  
347 0-.3479,-04,-.1067,-04,-.1677,-05,-.9273,-05,-.2434,-04,  
348 1-.9237,-05,-.2097,-04,-.1855,-04,-.2252,-04,-.1561,-04,  
349 2+.1366,-04,-.1586,-04,-.2738,-04,-.2521,-04,-.3504,-04,  
350 3+.8170,-05,-.1468,-04,-.1103,-04,-.7204,-05,-.1921,-04,  
351 4-.9357,-05,-.3371,-04,-.1044,-03,-.2277,-04,-.1851,-04,  
352 5-.5013,-04,-.1226,-04,-.7684,-04,-.9007,-05,-.3069,-04,  
353 6-.1503,-04,-.1428,-04,-.7684,-04,-.4256,-04,-.1115,-04,  
354 7-.9924,-05,-.2533,-05,-.1264,-04,-.2342,-05,-.1403,-04,  
355 8-.4109,-05,-.1158,-04,-.1844,-04,-.1637,-05,-.2904,-04,  
356 9-.8666,-05,-.7699,-06,-.1902,-04,-.1174,-04,-.2235,-04/  
357 DATA C(2,1),CX(2,1),I=50,99)/  
358 A-.3846,-04,-.1764,-04,-.1922,-04,-.3201,-04,-.3647,-04,  
359 B-.5262,-06,-.1321,-04,-.1488,-04,-.1163,-04,-.2164,-04,  
360 C-.3156,-04,-.1313,-04,-.3354,-05,-.2937,-04,-.2322,-05,  
361 0-.3612,-04,-.1213,-04,-.1211,-03,-.3442,-04,-.2032,-04,  
362 1+.1695,-05,-.3049,-04,-.6536,-05,-.9824,-05,-.2052,-04,  
363 2-.6636,-05,-.2994,-05,-.1366,-04,-.1516,-04,-.2417,-04,  
364 3-.1195,-04,-.6051,-05,-.1623,-04,-.1713,-05,-.2799,-05,  
365 4-.9214,-04,-.7205,-05,-.4001,-05,-.4412,-05,-.2237,-04,  
366 5+.3438,-04,-.1475,-04,-.1234,-04,-.3569,-04,-.1435,-04,  
367 6-.7795,-05,-.2321,-05,-.6036,-05,-.7578,-05,-.6852,-05/  
368 DATA C(2,1),CX(2,1),I=100,151)/  
369 7+.2440,-04,-.1810,-04,-.4162,-04,-.5349,-06,-.3700,-04,  
370 8-.1805,-04,-.8224,-05,-.1999,-04,-.5533,-04,-.3394,-04,  
371 9+.5456,-04,-.8086,-05,-.4517,-05,-.1255,-04,-.6055,-07,  
372 A-.1597,-04,-.5223,-05,-.2196,-04,-.3244,-04,-.3932,-04,  
373 B-.1170,-04,-.3800,-04,-.3620,-05,-.3239,-04,-.7041,-05,  
374 1-.9113,-05,-.2247,-04,-.3063,-04,-.6475,-04,-.1230,-03,  
375 2-.5180,-04,-.4302,-06,-.4932,-04,-.5634,-05,-.1934,-04,  
376 3+.8812,-04,-.8560,-05,-.1413,-04,-.2136,-04,-.1692,-04,  
377 4-.4697,-06,-.1811,-04,-.2045,-04,-.1218,-04,-.8175,-04,  
378 5-.1406,-04,-.2523,-04,-.5700,-05,-.8643,-05,-.1338,-04,  
379 6-.1194,-04,-.4694,-04/  
380 DATA C(1,1),CX(1,1),I=1,53)/  
381 4-.2183,-03,-.2767,-04,-.5499,-04,-.5661,-04,-.1860,-04,  
382 1-.1346,-04,-.3534,-04,-.5837,-03,-.6739,-04,-.4747,-04,  
383 2-.1143,-03,-.3439,-04,-.2482,-03,-.1810,-04,-.1420,-04,  
384 3-.1353,-04,-.1844,-04,-.1548,-04,-.5291,-04,-.1793,-04,  
385 4-.1087,-04,-.5324,-03,-.2173,-03,-.1325,-04,-.2980,-03,  
386 5-.1192,-03,-.7670,-04,-.2323,-04,-.1765,-04,-.3739,-04,  
387 6-.2266,-04,-.9437,-03,-.4408,-04,-.2117,-03,-.2501,-03,  
388 7-.2579,-04,-.1612,-04,-.1948,-04,-.1741,-04,-.4465,-04,  
389 8-.1425,-04,-.1329,-04,-.3385,-03,-.1064,-04,-.1076,-04,  
390 9-.7833,-04,-.2193,-04,-.2527,-03,-.2856,-03,-.3927,-03/  
391 DATA C(1,1),CX(1,1),I=51,100)/

392 A-.1633,-04,-.4009,-04,-.1668,-05,-.2175,-04,-.1284,-04,  
393 B-.6843,-04,-.1216,-03,-.1749,-03,-.1676,-04,-.6251,-03,  
394 0-.2291,-04,-.7153,-03,-.1025,-04,-.2683,-03,-.4292,-03,  
395 1-.3418,-04,-.5536,-02,-.5799,-03,-.8686,-05,-.1359,-04,  
396 2-.1201,-04,-.3357,-03,-.1742,-04,-.5421,-04,-.2859,-04,  
397 3-.8581,-04,-.1730,-03,-.3653,-04,-.1792,-04,-.2612,-03,  
398 4-.1744,-04,-.3213,-04,-.5986,-04,-.7404,-04,-.4396,-02,  
399 5-.2442,-03,-.1731,-04,-.1143,-04,-.2572,-04,-.5739,-04,  
400 6-.2141,-04,-.3375,-03,-.1936,-04,-.1869,-04,-.7837,-04,  
401 7-.2273,-04,-.5484,-04,-.7237,-04,-.1121,-04,-.2626,-04/  
402 DATA (D(1,I),DX(1,I),I=101,150)/  
403 8-.8437,-04,-.5394,-03,-.7236,-04,-.1054,-02,-.3914,-04,  
404 9-.2941,-04,-.3913,-04,-.4921,-03,-.1613,-04,-.2653,-04,  
405 A-.6534,-04,-.6087,-05,-.4260,-04,-.1478,-04,-.6752,-04,  
406 B-.8777,-04,-.1577,-04,-.2479,-04,-.4369,-04,-.5848,-04,  
407 1-.2411,-03,-.1689,-04,-.2394,-03,-.1229,-04,-.4371,-04,  
408 2-.4391,-04,-.5690,-03,-.2662,-03,-.2744,-03,-.2545,-03,  
409 3-.3572,-03,-.3383,-03,-.2985,-04,-.8643,-05,-.3499,-04,  
410 4-.2120,-03,-.2563,-04,-.3324,-04,-.1694,-04,-.8297,-04,  
411 5-.1566,-04,-.1337,-04,-.3232,-03,-.1457,-02,-.3488,-04,  
412 6-.7471,-03,-.6403,-04,-.4280,-04,-.4018,-04,-.5336,-04/  
413 DATA (D(1,151),DX(1,151),(D(2,I),DX(2,I),I=1,49)/  
414 7-.1033,-02,-.5819,-03,-.4632,-04,-.2563,-03,-.2370,-03,  
415 1-.4797,-04,-.2753,-04,-.9533,-04,-.1765,-04,-.1798,-03,  
416 2-.8227,-04,-.2960,-03,-.1147,-03,-.6278,-03,-.6828,-04,  
417 3-.3035,-04,-.3237,-03,-.4728,-04,-.4165,-04,-.1144,-03,  
418 4-.4022,-04,-.8644,-04,-.2082,-02,-.5616,-03,-.2993,-04,  
419 5-.7688,-03,-.3214,-03,-.1867,-03,-.4964,-04,-.2943,-04,  
420 6-.9998,-04,-.4560,-04,-.2551,-02,-.7259,-04,-.5351,-03,  
421 7-.5104,-03,-.6474,-04,-.6683,-04,-.5127,-04,-.3485,-04,  
422 8-.1504,-03,-.2791,-04,-.2770,-04,-.7013,-03,-.6266,-04,  
423 9-.2729,-04,-.1997,-03,-.5199,-04,-.6303,-03,-.5944,-03/  
424 DATA (D(2,I),DX(2,I),I=50,99)/  
425 A-.1585,-02,-.5733,-04,-.1312,-03,-.4162,-04,-.7382,-04,  
426 B-.2931,-04,-.1771,-03,-.3026,-03,-.4001,-03,-.5041,-04,  
427 0-.1446,-02,-.4823,-04,-.1659,-02,-.2099,-04,-.4824,-03,  
428 1-.1375,-02,-.9346,-04,-.1165,-01,-.1436,-02,-.4779,-04,  
429 2-.3167,-04,-.3437,-04,-.8711,-03,-.4920,-04,-.1357,-03,  
430 3-.8058,-04,-.2107,-03,-.2531,-03,-.8193,-04,-.3601,-04,  
431 4-.6398,-03,-.3848,-04,-.7248,-04,-.1348,-03,-.2284,-03,  
432 5-.8851,-02,-.6407,-03,-.3940,-04,-.2944,-04,-.6964,-04,  
433 6-.1316,-03,-.5283,-04,-.8735,-03,-.6768,-04,-.3897,-04,  
434 7-.2064,-03,-.6621,-04,-.1192,-03,-.2554,-03,-.1362,-03/  
435 DATA (D(2,I),DX(2,I),I=130,151)/  
436 8-.5360,-04,-.6393,-03,-.1317,-02,-.5561,-04,-.2786,-02,  
437 9-.3371,-04,-.7026,-04,-.9769,-04,-.1126,-02,-.5767,-04,  
438 A-.4615,-04,-.1210,-03,-.1847,-03,-.8249,-04,-.3125,-04,  
439 B-.2154,-03,-.2132,-03,-.6733,-04,-.1397,-03,-.7612,-04,  
440 0-.1491,-03,-.9571,-03,-.3837,-04,-.5086,-03,-.3489,-04,  
441 1-.7819,-04,-.1075,-03,-.1426,-02,-.1561,-03,-.1337,-03,  
442 2-.5832,-03,-.2540,-03,-.8316,-03,-.3536,-04,-.1838,-04,  
443 3-.5538,-04,-.5962,-03,-.1159,-03,-.6525,-04,-.3466,-04,  
444 4-.2195,-03,-.2713,-04,-.2545,-04,-.1124,-02,-.2129,-02,  
445 5-.9214,-04,-.2095,-02,-.1752,-03,-.8239,-04,-.9951,-04,  
446 6-.1402,-03,-.3288,-02/  
447 DATA (F(1,I),FY(1,I),I=1,57)/

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448  ++.8983,-05,+.1847,-05,+.6823,-05,+.5443,-05,+.5386,-06,
449  1+.2923,-05,+.2576,-05,+.2555,-04,+.1655,-05,+.7418,-05,
450  2+.6885,-05,+.8035,-06,+.1253,-04,+.1888,-05,+.2602,-05,
451  3+.1054,-04,+.4151,-06,+.1219,-05,+.4178,-05,+.2343,-05,
452  4+.6477,-05,+.9016,-04,+.8177,-05,+.5207,-06,+.2372,-04,
453  5+.6374,-05,+.6511,-05,+.1533,-05,+.4133,-05,+.2360,-05,
454  6+.3895,-05,+.4528,-04,+.8938,-05,+.1439,-04,+.2443,-04,
455  7+.2832,-05,+.1010,-04,+.1833,-05,+.3296,-05,+.3231,-05,
456  8+.1457,-05,+.2933,-05,+.7476,-05,+.9339,-05,+.1337,-05,
457  9+.5318,-05,+.2795,-05,+.1139,-04,+.2178,-04,+.1859,-04/
458  DATA (E(1,I),EX(1,I),I=51,100)/
459  A+.1202,-05,+.1973,-05,+.3843,-05,+.7685,-06,+.1655,-05,
460  B+.7631,-05,+.7361,-05,+.1389,-04,+.7129,-06,+.5670,-04,
461  C+.3661,-05,+.1489,-04,+.3078,-05,+.1700,-04,+.2711,-04,
462  D+.2328,-05,+.9855,-03,+.5137,-04,+.7579,-05,+.2272,-05,
463  E+.7029,-05,+.8223,-05,+.1600,-05,+.3505,-05,+.1413,-05,
464  F+.6717,-05,+.8229,-04,+.4452,-05,+.3713,-05,+.1739,-04,
465  G+.1271,-05,+.8497,-06,+.8448,-05,+.7142,-05,+.8540,-03,
466  H+.8673,-05,+.2122,-05,+.1693,-05,+.1393,-06,+.6705,-05,
467  I+.1298,-05,+.3818,-04,+.1164,-06,+.3847,-05,+.3832,-05,
468  J+.3432,-06,+.6848,-05,+.9336,-06,+.9528,-05,+.4875,-05/
469  DATA (E(1,I),EX(1,I),I=101,150)/
470  K+.4753,-04,+.5018,-04,+.2623,-05,+.3509,-04,+.1993,-05,
471  L+.3001,-05,+.1195,-05,+.4931,-04,+.8572,-06,+.6965,-05,
472  M+.7015,-05,+.8690,-05,+.4233,-05,+.2873,-05,+.6995,-05,
473  N+.2988,-05,+.3614,-05,+.9975,-05,+.7697,-05,+.3931,-05,
474  O+.1451,-04,+.2633,-05,+.1824,-04,+.3299,-06,+.3451,-05,
475  P+.2429,-05,+.4095,-04,+.9598,-04,+.9152,-04,+.1152,-04,
476  Q+.8723,-04,+.2738,-04,+.1553,-05,+.2339,-05,+.9232,-05,
477  R+.1840,-04,+.3111,-05,+.3057,-05,+.3288,-05,+.2972,-05,
478  S+.2483,-05,+.3090,-05,+.1563,-04,+.4253,-03,+.1555,-05,
479  T+.3423,-04,+.3052,-05,+.2346,-05,+.3354,-05,+.1384,-05/
480  DATA (E(1,151),EX(1,151),E(2,I),EX(2,I),I=1,49)/
481  U+.3144,-04,+.2848,-04,+.6591,-05,+.8658,-05,+.4112,-05,
482  V+.3536,-05,+.7467,-05,+.9920,-05,+.4529,-04,+.7663,-05,
483  W+.1840,-04,+.2145,-04,+.6069,-05,+.3471,-04,+.6992,-06,
484  X+.7057,-05,+.3087,-04,+.2469,-05,+.5454,-06,+.1203,-04,
485  Y+.7730,-05,+.7214,-05,+.1055,-03,+.2853,-04,+.3104,-05,
486  Z+.5921,-04,+.2053,-04,+.1361,-04,+.5894,-05,+.9385,-05,
487  AA+.9150,-05,+.9797,-05,+.1412,-03,+.1982,-04,+.4402,-04,
488  AB+.5811,-04,+.8749,-05,+.1598,-04,+.4178,-05,+.8292,-05,
489  AC+.1186,-05,+.4314,-05,+.7219,-05,+.1996,-04,+.1431,-04,
490  AD+.4271,-05,+.2043,-04,+.8216,-05,+.3722,-04,+.5846,-04/
491  DATA (E(2,I),EX(2,I),I=50,99)/
492  AE+.1683,-04,+.9862,-06,+.5707,-06,+.5681,-05,+.1753,-05,
493  AF+.5365,-05,+.1359,-04,+.2277,-04,+.3128,-04,+.2150,-05,
494  AG+.1421,-03,+.7662,-05,+.3774,-04,+.7443,-05,+.4891,-04,
495  AH+.8287,-04,+.9012,-05,+.2193,-02,+.1341,-03,+.1321,-04,
496  AI+.6693,-05,+.7412,-05,+.2470,-04,+.6013,-05,+.1315,-04,
497  AJ+.5251,-05,+.2418,-04,+.1508,-03,+.1209,-04,+.9647,-05,
498  AK+.5053,-04,+.4875,-05,+.6164,-05,+.1986,-04,+.2484,-04,
499  AL+.1897,-02,+.2812,-04,+.6439,-05,+.5043,-05,+.3689,-05,
500  AM+.1917,-04,+.5852,-05,+.1253,-03,+.4724,-04,+.1107,-04,
501  AN+.1489,-04,+.2510,-05,+.1773,-04,+.8826,-05,+.1676,-04/
502  DATA (E(2,I),EX(2,I),I=100,151)/
503  AO+.1204,-04,+.5623,-04,+.1258,-03,+.7852,-05,+.1208,-03,

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504 7+.8349,-05+.9540,-05+.5303,-05+.1179,-06+.2458,-05,  
505 A+.1594,-04+.1696,-04+.1211,-04+.1153,-04+.8583,-05,  
506 B+.6481,-05+.1320,-04+.4484,-05+.1461,-04+.1718,-04,  
507 0+.1344,-04+.1430,-04+.7561,-05+.5291,-04+.1467,-05,  
508 1+.1125,-04+.8214,-05+.1023,-03+.1572,-33+.1486,-03,  
509 2+.4362,-04+.1641,-03+.6800,-04+.5131,-05+.6377,-05,  
510 3+.2091,-04+.5176,-04+.1109,-04+.8881,-05+.8351,-05,  
511 4+.1446,-04+.5500,-05+.7699,-05+.5357,-04+.8296,-03,  
512 5+.7348,-05+.9134,-04+.1341,-04+.8698,-05+.1208,-04,  
513 6+.6735,-05+.3523,-04/  
514 DATA (F(1,I),FX(1,I),I=1,60)/  
515 +.9167,-06+.5586,-03+.3106,-06+.3266,-06+.6468,-06+.2389,-06,  
516 1.4951,-06+.1649,-05+.1151,-05+.6108,-06+.5391,-06+.4916,-06,  
517 2.5796,-06+.3481,-06+.2757,-06+.5159,-06+.5463,-06+.6075,-06,  
518 3.4383,-06+.6620,-06+.7299,-06+.9504,-05+.9872,-06+.4306,-06,  
519 4.1421,-06+.5613,-06+.5472,-06+.5493,-06+.2239,-06+.4012,-06,  
520 5.3901,-06+.3040,-05+.1260,-06+.1665,-06+.7077,-06+.3508,-06,  
521 6.8112,-06+.3495,-06+.3489,-06+.6065,-06+.3508,-06+.1804,-06,  
522 7.6266,-06+.4511,-06+.1943,-06+.6873,-06+.3278,-06+.1561,-05,  
523 8.4311,-06+.2434,-05+.2754,-06+.8810,-06+.3592,-06+.4739,-06,  
524 9.2857,-06+.6974,-06+.5675,-06+.4482,-06+.8649,-06+.9180,-06/  
525 DATA (F(1,I),FX(1,I),I=61,120)/  
526 1.4132,-06+.2547,-05+.1827,-06+.3402,-06+.2454,-05+.4190,-06,  
527 2.1212,-04+.9146,-06+.2571,-06+.3034,-06+.6612,-06+.8465,-06,  
528 3.3725,-06+.3626,-06+.6812,-06+.6800,-06+.5314,-05+.5495,-06,  
529 4.2698,-06+.7482,-06+.4761,-06+.4629,-06+.1298,-06+.6427,-06,  
530 5.3815,-04+.4500,-06+.3079,-06+.2153,-06+.9897,-06+.6480,-06,  
531 6.6628,-06+.5379,-06+.6830,-06+.4511,-06+.7583,-06+.6574,-06,  
532 7.4731,-06+.1154,-05+.7016,-06+.4592,-06+.1860,-05+.5761,-06,  
533 8.3273,-06+.1544,-05+.4763,-06+.4574,-06+.3686,-06+.7548,-06,  
534 9.6340,-06+.3795,-06+.2254,-06+.4999,-06+.4660,-06+.3299,-06,  
535 0.1945,-05+.1370,-05+.6544,-06+.4473,-06+.1681,-07+.5014,-06/  
536 DATA (F(1,I),FX(1,I),I=121,151),(F(2,I),FX(2,I),I=1,29)/  
537 1.9672,-06+.3335,-06+.4194,-06+.5187,-06+.4819,-06+.6508,-06,  
538 2.9378,-06+.6825,-05+.5872,-05+.2601,-05+.8805,-06+.8887,-06,  
539 3.5567,-06+.3224,-06+.2197,-06+.2674,-06+.6231,-06+.4496,-06,  
540 4.3594,-06+.7149,-06+.2488,-06+.2905,-06+.1890,-05+.1993,-04,  
541 5.7449,-06+.2742,-06+.6694,-06+.7722,-06+.5473,-06+.8987,-06,  
542 0.6555,-05+.1802,-05+.6190,-06+.1811,-05+.2238,-05+.9341,-06,  
543 1.3757,-06+.1441,-05+.3735,-05+.1740,-05+.6123,-06+.1812,-05,  
544 2.2110,-05+.2182,-05+.1750,-05+.4277,-06+.1527,-05+.7172,-06,  
545 3.1364,-05+.8673,-06+.9993,-06+.2856,-05+.3316,-04+.2118,-05,  
546 4.9159,-06+.2767,-05+.1537,-05+.1238,-05+.9241,-06+.1451,-06/  
547 DATA (F(2,I),FX(2,I),I=30,49)/  
548 5.1156,-05+.4305,-06+.9736,-05+.3130,-06+.1032,-05+.3262,-06,  
549 6.7161,-06+.2089,-05+.6655,-06+.3459,-06+.1334,-05+.3775,-06,  
550 7.3448,-06+.1344,-05+.2039,-05+.4892,-06+.1147,-05+.7147,-06,  
551 8.1998,-05+.8361,-06+.9753,-05+.9567,-06+.1438,-05+.1709,-05,  
552 9.1630,-05+.5232,-06+.1574,-05+.1648,-05+.1598,-05+.1557,-05,  
553 0.7918,-06+.4642,-06+.3657,-06+.2279,-06+.1256,-05+.4995,-05,  
554 1.1022,-05+.1014,-03+.1488,-05+.1622,-05+.5723,-06+.1946,-05,  
555 2.1732,-05+.2197,-06+.1089,-05+.1918,-05+.1267,-05+.1218,-04,  
556 3.6736,-06+.3909,-06+.1463,-05+.6774,-06+.1304,-05+.1316,-06,  
557 4.9284,-06+.8552,-06+.1615,-05+.5793,-06+.5209,-06+.1587,-05/  
558 DATA (F(2,I),FX(2,I),I=50,151)/  
559 5.4377,-06+.1241,-05+.1827,-06+.2454,-05+.4190,-06,

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560 6.8877,-36.7333,-36.1477,-05.7811,-36.4313,-36.7618,-05.
561 7.1208,-05.6442,-06.3880,-05.1380,-05.9243,-06.1087,-05.
562 8.1647,-35.1577,-35.1137,-06.1588,-06.1291,-05.6351,-06.
563 9.5069,-06.2234,-05.1657,-05.1562,-05.2332,-05.5540,-6.
564 0.1447,-35.6730,-35.5941,-06.1482,-35.7637,-36.1001,-05.
565 1.1140,-05.2609,-05.2115,-04.1873,-04.5070,-05.8281,-05.
566 2.2732,-35.5376,-35.4373,-06.6951,-6.8137,-36.1410,-05.
567 3.8182,-06.4378,-06.1367,-05.2597,-06.3332,-06.2813,-05.
568 4.1678,-34.1396,-35.1884,-05.1420,-05.8826,-36.1366,-05.
569 5.1341,-05.1675,-04.
570 DATA L)/63.07,129.60,89.23,87.53,128.61,124.75,93.21,42.82,98.37,
571 1104.83,70.62,95.47,62.78,135.46,135.78,66.71,163.13,121.50,112.82,
572 2113.10,108.64,32.59,64.95,174.38,54.10,72.52,76.79,117.77,118.19,
573 3100.96,110.51,36.94,97.97,58.69,61.39,110.21,116.00,126.83,112.31,
574 4103.96,174.29,129.85,64.47,142.74,166.66,74.36,119.08,59.88,63.09,
575 539.29,162.39,110.18,170.47,143.01,148.42,81.97,71.67,66.03,121.23,
576 644.78,139.21,59.34,132.15,58.25,43.12,102.74,23.48,45.17,144.88,
577 7129.85,159.95,64.61,117.77,96.03,113.72,72.84,50.77,94.64,110.10,
578 857.32,142.70,133.77,99.15,72.66,25.81,62.74,138.25,149.36,110.63,
579 979.96,118.03,44.02,112.74,97.30,76.72,125.31,83.82,79.94,106.15,
580 077.39,49.82,47.32,117.31,46.62,98.14,134.56,132.33,46.09,136.18,
581 197.00,109.69,106.36,125.50,114.52,77.13,77.33,136.71,116.13,98.56,
582 283.74,52.33,126.97,66.67,160.43,76.35,115.53,46.52,45.91,70.38,
583 358.75,68.62,62.84,163.20,128.50,91.29,56.45,87.97,128.78,117.85,
584 478.95,147.77,126.33,46.79,33.65,99.42,53.44,79.71,120.83,88.17,
585 595.37,38.13/
586
587 NAME=NAME$ (I)
588 L=LD(I)
589 PA=A(J,I)*10.0**AY(J,I)
590 PB=B(J,I)*10.0**BX(J,I)
591 PC=C(J,I)*10.0**CX(J,I)
592 PD=D(J,I)*10.0**DX(J,I)
593 PE=E(J,I)*10.0**EX(J,I)
594 PF=F(J,I)*10.0**FX(J,I)
595 RETURN
596 END

```

## SHCOST(1).WBSIN

```

1      SUBROUTINE WBSIN
2      INCLUDE PARS
3      INTEGER TYPE
4      1    CONTINUE
5      CALL S9LNK
6      CALL PAGES(99)
7      WRITE(6,110)
8      30   READ(5,40) IBLK, CODE, TITLE, (ISUB(I1), I1=2,K1)
9      40   FORMAT(13,A5,6A4,16I3)
10      IF(I1LK.EQ.0) RETURN
11      IF(I1LK.GT.IS17.AND.I1LK.LT.IC1.OR.I1LK.GT.IC16) GO TO 50
12      ISUB(1)=I1LK
13      50   WRITE(6,25) IBLK, CODE, TITLE
14      WRITE(8,I1LK,ERR=600) ISUB, CODE, TITLE
15      GO TO 30
16      600  WRITE(6,601)
17      601  FORMAT(5X, 'ERROR IN WBSIN')
18      110  FORMAT(2X, 'WBS DICTIONARY', //)
19      25   FORMAT(5X, I5, 2X, A5, 2X, 6A4)
20      RETURN
21      C    DEQUS INIT, SUBTRACE, TRACE
22      C    AT 1
23      C    TRACE ON
24      END

```

APRT, TL A.

## SHCOST(1) ELEMENT TABLE

ID	NAME	VERSION	TYPE	DATE	TIME	SEQ #	SIZE-PRE, TEXT	(CYCLE WORD)	PSRMODE	LOCATION
	SALVAG		FOR SYMB	19 DEC 78	12:33:37	1	7	5 13 5		1792
	LIFCYC		ELT SYMB	21 DEC 78	15:50:30	2	35	5 47 5		1799
	SKALE		FOR SYMB	30 JAN 79	09:32:05	3	2	5 3 1		1834
	NETREP		FOR SYMB	30 JAN 79	12:05:19	4	36	5 35 5		1836
	SBLNK		FOR SYMB	14 FEB 79	12:55:51	5	7	5 5 5		1872
	CALLID		FOR SYMB	08 MAR 79	14:42:13	6	6	5 0 1		1879
	LEGEND		ELT SYMB	23 MAR 79	07:51:07	7	9	5 22 5		1885
	PLOTS		ELT SYMB	11 APR 79	09:29:57	8	14	5 46 5		1894
	SAVE		ELT SYMB	02 JUL 79	11:52:14	9	18	5 3 1		1908
	DEPINC		FOR SYMB	05 JUL 79	11:38:00	10	27	5 36 5		1926
	TOTALS		FOR SYMB	05 JUL 79	11:37:28	11	15	5 46 5		1953
	SOLCST		FOR SYMB	21 DEC 78	13:45:04	12	14	5 21 5		1968
	ENERGY		FOR SYMB	18 JUL 79	13:11:36	13	18	5 45 5		1982
	POSAVE		ELT SYMB	23 JUL 79	07:54:25	14	18	5 26 5		2000
	PLTURV		ELT SYMB	15 AUG 79	09:26:48	15	24	5 15 5		2018
	PLTDV		RELOCATABLE	15 AUG 79	09:27:28	16	2	50	QIR	2042
	LEGEND		RELOCATABLE	15 AUG 79	09:58:33	17	2	14	QIR	2094
	CALLID		RELOCATABLE	15 AUG 79	10:03:27	18	2	13	QIR	2110
	SUNRIZ		FLT SYMB	17 AUG 79	09:18:09	19	27	5 24 5		2125
	SUNRIZ		RELOCATABLE	17 AUG 79	09:22:31	20	2	32	QIR	2145
	SFL		FLT SYMB	04 SEP 79	08:53:24	21	8	5 13 5		2179
	GO		ELT SYMB	19 SEP 79	08:55:03	22	9	5 7 5		2187
	TABLE		FLT SYMB	19 SEP 79	08:58:13	23	208	5 2 3		2196
	TARIF		RELOCATABLE	10 SEP 79	09:00:10	24	2	431	QIR	2204

SHCOST SOURCE LIST

DATE 092879

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SOLCST	RELOCATABLE	19 SEP 79	09:02:47	25	3	8				QIR	2837
DEPINC	RELOCATABLE	19 SEP 79	09:06:40	26	3	30				QIR	2848
ENERGY	RELOCATABLE	19 SEP 79	09:07:06	27	3	18				QIR	2881
NETREP	RELOCATABLE	19 SEP 79	09:07:34	28	3	33				QIR	2902
SALVAG	RELOCATABLE	19 SEP 79	09:09:34	29	3	6				QIR	2938
SBLNK	RELOCATABLE	19 SEP 79	09:13:07	30	2	5				QIR	2947
TOTALS	RELOCATABLE	19 SEP 79	09:11:29	31	3	15				QIR	2954
LIFCYC	RELOCATABLE	19 SEP 79	09:12:33	32	3	22				QIR	2972
POSAVE	RELOCATABLE	19 SEP 79	09:12:58	33	4	25				QIR	2997
GFL	RELOCATABLE	19 SEP 79	09:13:35	34	3	9				QIR	3026
PLOTS	RELOCATABLE	19 SEP 79	09:14:12	35	2	29				QIR	3038
SKALE	RELOCATABLE	19 SEP 79	09:14:41	36	1	3				QIR	3069
• SHMAP	MAP SYMB	19 SEP 79	09:26:48	37		2	5	4	5		3073
CYPHER	ELT SYMB	19 SEP 79	11:41:51	38		15	5	20	5		3075
CYPHER	RELOCATABLE	19 SEP 79	11:42:35	39	2	17				QIR	3090
PARS	FOR PROC	20 SEP 79	10:20:07	40		31	5	11	5		3109
LOAD	ELT SYMB	20 SEP 79	13:46:25	41		14	5	14	5		3140
LOAD	RELOCATABLE	20 SEP 79	13:47:04	42	3	19				QIR	3154
TEST1	ELT SYMB	20 SEP 79	14:23:21	43		21	5	6	5		3176
TEST2	ELT SYMB	20 SEP 79	14:24:07	44		18	5	1	2		3197
IFPRNT	FOR SYMB	21 SEP 79	07:59:42	45		31	5	53	5		3215
IFPRNT	RELOCATABLE	21 SEP 79	07:59:12	46	3	34				QIR	3246
TAXCST	FOR SYMB	21 SEP 79	08:12:20	47		28	5	47	5		3283
TAXCST	RELOCATABLE	21 SEP 79	08:12:40	48	3	29				QIR	3311
• PILE	ELT SYMB	21 SEP 79	11:43:18	49		8	5	19	5		3343
RFPRT	FOR SYMB	21 SEP 79	12:02:00	50		36	5	22	5		3351
RFPRT	RELOCATABLE	21 SEP 79	12:02:24	51	3	64				QIR	3387
CSTDIO	FOR SYMB	21 SEP 79	14:25:14	52		53	5	61	5		3454
CSTDIO	RELOCATABLE	21 SEP 79	14:25:59	53	3	89				QIR	3507
PAGES	ELT SYMB	21 SEP 79	14:26:51	54		12	5	17	5		3599
PAGES	RELOCATABLE	21 SEP 79	14:27:07	55	2	15				QIR	3611
C	ABSOLUTE	21 SEP 79	14:43:28	56		68				QIR	3628
AMORTZ	FOR SYMB	24 SEP 79	09:10:52	57		9	5	29	5		3696
AMORTZ	RELOCATABLE	24 SEP 79	09:11:13	58	3	11				QIR	3705
NFLATE	FOR SYMB	24 SEP 79	09:40:33	59		28	5	56	5		3719
NFLATE	RELOCATABLE	24 SEP 79	09:43:40	60	3	36				QIR	3747
CONCST	FOR SYMB	24 SEP 79	10:08:45	61		13	5	21	5		3786
CONCST	RELOCATABLE	24 SEP 79	10:09:15	62	3	5				QIR	3799
PVAC	FOR SYMB	24 SEP 79	10:09:54	63		18	5	62	5		3807
PVAC	RELOCATABLE	24 SEP 79	10:13:23	64	3	17				QIR	3825
RESULT	ELT SYMB	24 SEP 79	11:15:46	65		26	5	20	5		3845
RESULT	RELOCATABLE	24 SEP 79	11:16:02	66	5	34				QIR	3871
WBSIN	FOR SYMB	24 SEP 79	11:16:31	67		7	5	40	5		3910
WBSIN	RELOCATABLE	24 SEP 79	11:17:06	68	3	8				QIR	3917
TEST3	ELT SYMB	24 SEP 79	11:28:43	69		5	5	2	3		3928
HANSMAN	ELT SYMB	24 SEP 79	11:48:50	70		40	5	1	2		3933
CSTDIN	ELT SYMB	27 SEP 79	07:24:43	71		27	5	45	5		3973
CSTDIN	RELOCATABLE	27 SEP 79	07:25:00	72	3	24				QIR	4000
DIVVY	ELT SYMB	27 SEP 79	07:27:45	73		25	5	19	5		4027
DIVVY	RELOCATABLE	27 SEP 79	07:27:59	74	3	30				QIR	4052
SAMPLE	ELT SYMB	27 SEP 79	09:14:48	75		7	5	11	5		4085
SOLMAN	ELT SYMB	28 SEP 79	11:29:36	76		24	5	60	5		4092
SOLMAN	RELOCATABLE	28 SEP 79	11:30:31	77	5	14				QIR	4116
• SHCOST	ABSOLUTE	28 SEP 79	11:36:04	78		1051				QIR	4135
• SHCOST	ELT SYMB	28 SEP 79	12:39:49	79		2	5	3	1		5186
COST	ELT SYMB	28 SEP 79	12:43:07	80		2	5	1	1		5188

PROBLEM



# SHCOST SOURCE LIST

DATE 092879

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• SHCOST	RELOCATABLE	28 SEP 79	12:33:29	81	2	4			QIR	5190
MAP	ELT SYMB	28 SEP 79	12:34:34	82		1	5	3	1	5196
• SHCOST	ELT SYMB	28 SEP 79	12:34:20	83		2	5	1	2	5197
• SHCOST	RELOCATABLE	28 SEP 79	12:34:39	84	2	4			QIR	5199
• SHCOST	ABSOLUTE	28 SEP 79	12:34:40	85		71			QIR	5205
• BEGIN	ELT SYMB	28 SEP 79	12:35:48	86		1	5	0	1	5276
• BEGIN	ELT SYMB	28 SEP 79	12:36:48	87		1	5	1	2	5277
• BEGIN	ELT SYMB	28 SEP 79	12:38:03	88		1	5	2	3	5278
• SHCOST	ELT SYMB	28 SEP 79	12:38:16	89		3	5	2	3	5279
• SHCOST	RELOCATABLE	28 SEP 79	12:38:29	90	2	5			QIR	5282
• SHCOST	ABSOLUTE	28 SEP 79	12:38:31	91		71			QIR	5289
BEGIN	ELT SYMB	28 SEP 79	12:40:07	92		1	5	3	4	5360
• SHCOST	ELT SYMB	28 SEP 79	12:41:33	93		3	5	3	4	5361
• SHMAP	MAP SYMB	28 SEP 79	12:41:25	94		2	5	5	5	5364
• SHCOST	ELT SYMB	28 SEP 79	12:42:05	95		3	5	4	5	5366
• SHMAP	MAP SYMB	28 SEP 79	12:42:51	96		2	5	6	5	5369
SHMAP	MAP SYMB	28 SEP 79	12:43:38	97		2	5	7	5	5371
COST	ABSOLUTE	28 SEP 79	12:43:42	98		1751			QIR	5373
• SHCOST	ELT SYMB	28 SEP 79	12:47:25	99		3	5	5	5	6424
• SHCOST	ABSOLUTE	28 SEP 79	12:47:46	100		71			QIR	6427
• SHCOST	ELT SYMB	28 SEP 79	12:48:10	101		3	5	6	5	6498
SHCOST	ELT SYMB	28 SEP 79	12:48:41	102		4	5	7	5	6501
SHCOST	RELOCATABLE	28 SEP 79	12:48:53	103	2	6			QIR	6505
SHCOST	ABSOLUTE	28 SEP 79	12:48:55	104		72			QIR	6513
PILE	ELT SYMB	28 SEP 79	12:58:24	105		6	5	20	5	6585
										6591

NEXT AVAILABLE LOCATION-

ASSEMBLER PROCEDURE TABLE EMPTY

COBOL PROCEDURE TABLE EMPTY

## FORTRAN PROCEDURE TABLE

D NAME	LOCATION	LINK	D NAME	LOCATION	LINK	D NAME	LOCATION	LINK
PARS	87C54	40						

FNTR POINT TABLE EMPTY

SHDS,N

SHRKPT PRINTS